Exploring Digital Time Measurement in the Public Sector: Labor Productivity and Service Quality in Home Care

Henrik Jordahl and Lovisa Persson

Exploring Digital Time Measurement in the Public Sector[*]

Labor Productivity and Service Quality in Home Care

Henrik Jordahl[♣]
Lovisa Persson[♠]

May 2, 2018

Abstract

We measure labor productivity in home care using new data from the recent introduction of digital time measurement in Swedish municipalities. By measuring worker utilization (delivered hours as a share of worked hours) we avoid several problems that have plagued previous studies of public sector productivity. The time use measure exposes substantial variation in productivity between home care units, suggesting room for improvement. More productive units deliver a larger share of the hours approved by care managers and have equally satisfied users.

Keywords: Public sector productivity, digitalization, time use, choice reforms

JEL codes: H42, H45, L33

1. Introduction

Increasing the productivity of public sector services is crucially important but notoriously difficult to achieve. The need for personal interaction and a human touch imply that attempts to improve productivity are problematic and often met with objections. As argued by Baumol (1967, 1993), the service intensity of the public sector implies that it cannot keep pace with private sector productivity. In fact, there was virtually no productivity growth in the UK public sector between 1997 and 2013 (Office for National Statistics 2016). A troublesome trade-off between productivity and service quality in high-contact services is often offered as the explanation.

We study the proposed trade-off between productivity and quality by collecting and analyzing a new data set on productivity in home care. The data set is made possible by the recent adoption of digital tracking of time use and home care visits in several Swedish municipalities, the main providers of elderly care in Sweden. The trend towards digital tracking of service production and delivery could be seen either as a promise or a threat. Digital tracking equips management with improved measures of service production, information which can be used to increase productivity by introducing new ways to organize and substitute labor.[1] Developing new and efficient ways of delivering care services to the elderly is particularly important in light of the aging population in developed countries.[2] Alternatively, the new technology could harm workers and clients by inciting an excessive focus on productivity.

Since a few years back, home care workers in several Swedish municipalities use mobile phones or tags to log in and out of each client's home. This procedure provides an exact output measure in the form of *delivered hours*. Combining this output measure with the total amount of hours worked (input), we obtain a measure of labor productivity that we refer to as *worker utilization*: the share of total hours worked that is spent performing direct service work in the homes of the clients.[3] This measure of productivity is an improvement on earlier measures, such as cost-per-client, that have previously been used widely to analyze productivity in elderly care and public services in general.

It is well-known that the consumption and valuation of services differ from the consumption and valuation of manufactured goods. First, the *intangibility* of services implies that a service is a performance rather than an object. Second, the need for customization from client to client implies that services are comparably *heterogenous*. Third, the production and consumption of a service are *inseparable* as they take place at the same time. These characteristics complicate the assessment of service quality, at least in an objective sense. The relevant literature proposes

---

[1] Recently, both the European Commission (2015) and the OECD (2016) have collected examples of innovations and new technologies that aim at improving quality, independence, and efficiency in elderly care services.

[2] According to predictions for OECD countries, the share of people 65 years and older will increase from 17.0 percent in 2017 to 25.2 percent in 2050. The country with the oldest population is Japan, where the share of people 65 years and older is projected to increase from 28 to almost 40 percent. The share in the United States is projected to increase from 16 to 21 percent and the share in Sweden from 20 to 24 percent (see *Historical population data and projections (1950-2015)* at stats.oecd.org).

[3] Since worker costs (in direct production) make up 80 percent of total costs in home care the measure will also be informative about total factor productivity, see SALAR (2009).

that service quality is more of a subjective evaluation that depends on client expectations (Parasuraman *et al.* 1985).

Furthermore, because of the special characteristics of services, increased productivity is often seen as a relatively tall order. When workers are asked to take on more clients per day, critical elements of service quality could be lost, be it customization, personal interaction, or the transferal of emotions important to the client. Emphasizing the difficulty of evaluating service quality, Olivia and Sterman (2001) develop and test a model that describes the process of service erosion. As managers introduce new ambitious output goals in a high-contact service, workers will cope by "cutting corners" or putting in overtime work. The model thus describes a boundedly rational decision-making system, where only bad or incomplete information about quality is available, and where narrow productivity measures overestimate "true" productivity. We refer to this as the *dysfunctional view*: because of a misunderstanding of the nature of the service itself, and/or the inaccessibility of immediate information on service quality, there will be a negative relationship between a narrowly defined productivity measure and service quality.

There is also the possibility that service providers choose rationally among different combinations of productivity and quality according to their individual situation. In this view we assume, according to microeconomic theory, that resources are employed optimally such that there cannot exist a free lunch that raises both productivity and quality. We refer to this as the *microeconomic view*: because of different tastes for service quality contra productivity, and because production is already optimized, we expect a negative relationship between productivity and service quality.

Finally, we must also consider the possibility of a positive relationship between productivity and service quality. In Bloom *et al.* (2015) higher productivity is seen as the result of better management practices, which could contribute to both cheaper and better services. We refer to this as the *managerial view*: because some managers are better at innovating in a quality-preserving way, or at investing surplus in quality improvements, we expect to see a positive relationship between productivity and service quality. There is also the possibility that managers produce a surplus but do not invest it into higher quality. If so we should expect a zero relationship.

Using responses to a survey among clients, we find that home care units with higher worker utilization have equally satisfied clients as care units with lower worker utilization.[4] This result is in line with a study by Glenngård (2013) on productivity trade-offs in Swedish primary care. As an additional measure of quality, we also analyze the hours clients receive as a share of the number of approved hours. Approved hours are the hours that clients are entitled to according to care needs assessment. We refer to this variable as the rate of *service delivery*. We find a strong and positive relationship between worker utilization and service delivery. By comparing

---

[4] Earlier studies on productivity and quality in health care and elderly care have used mortality rates as a measure of quality (Gaynor et. al. 2016, Gaynor et. al 2013, Bergman et. al. 2016). Mortality is however not as suitable as a quality measure in home care since the elderly clients there do not have as high mortality rates as the elderly who live in nursing homes or as those who acutely seek care at a hospital. Other studies have used care unit survey data on mostly procedural and structural quality (see Stolt et. al. 2011, Stolt et. al 2017 for this kind of data on nursing homes).

municipalities with different provider compensation systems, and municipalities with different levels of approved hours, we get indications that the positive relationship between worker utilization and service delivery is driven by the working practices of care units rather than by varying short-term realizations of client needs.

Overall, our findings of a zero relationship between productivity and client satisfaction, as well as on the role of the compensation system in generating higher productivity in a way that is beneficial for clients (since they receive more of the hours they need), are consistent with the managerial view of service production. In other words, a substantial part of the differences in worker utilization of up to 30 percentage points (mean worker utilization is 58 percent) might reflect differences in management quality and could thus be eradicated through improvements in management practices without sacrificing service quality. We would however like to stress that additional research on more extended data sets is needed to draw sharper conclusions concerning our findings.

Worker utilization is a more precise and reliable productivity measure compared to earlier measures in the literature on public sector productivity. As suggested in the Atkinson Review (2005), the "cost-per-quality-adjusted-output" has usually been employed to estimate productivity in the public sector.[5] While this approach was an improvement on the earlier practice of equating inputs with outputs (implying constant productivity), each part of the measure has its own weaknesses. Which costs should be included? How should we measure output? What measures of quality should be included in the adjustment? A purely time-based productivity measure, such as our worker utilization measure, comes with several inherent benefits. By relating hours of output to hours of input we get a measure that is free from arbitrary cost allocations and quality adjustments. Productivity values between zero and 100 percent are also easy to interpret. While survey-based measures of worker utilization can be found in some earlier work (Hamermesh 1990; Burda *et al*. 2016), a measure based on digital logs is free from many unavoidable problems of traditional time use measures based on self-reports or assessments, such as: rounding errors, recall problems and strategic reporting. In home care, previous productivity measures have relied on the number of people receiving care or a cost-weighted index of output (Simpson 2009).

We make several contributions to the literature on productivity measurement in the service sector, and in the publicly provided care sector in particular. Not least, we provide insights on the potential risks of focusing on a narrow measure of productivity. These are valuable contributions considering the well-known shortage of relevant and precise productivity measures in publicly provided services. While being one of the most important economic questions in developed countries, we still know very little about the prospects for increased productivity in elderly care services. As the share of old people grows, the elderly care sector will demand a larger share of taxes and employment. The challenge to supply high quality elderly care in an efficient way will thus only become more urgent.

---

[5] See Arnek *et al.* (2013; 2016) for Swedish examples.

2. Elderly care in Sweden

Elderly care in Sweden is organized in accordance with the Nordic model of universal welfare. The guiding principle is to assure a "reasonable standard of living" for all elderly citizens, no matter their ability to pay. Elderly care services are thus primarily financed through redistributional municipal income taxes, while out-of-pocket payments cover only 5 percent of total costs. The municipalities, which is the lowest level of government in Sweden, carry the main responsibility for providing elderly care services to their citizens. The central government is primarily involved as a regulator and a legislator, although lately there has been an increase in intergovernmental targeted grants with the purpose of increasing staffing ratios. Despite increased restraint in needs assessments since the 1980s, the Swedish publicly financed system for elderly care is still one of the most generous and inclusive public systems of elderly care in the world (Erlandsson *et al.* 2013).

Ever since the 1950s, the outspoken strategy in Swedish elderly care has been to facilitate at home living for as long as possible. From the perspective of the elderly, the home care option maximizes independence and minimizes disruptions from regular living patterns (Ulmanen 2012).[6] From the perspective of the tax-payers, home care is cheaper than nursing homes, at least up to a certain level of care need. According to data from 2015, 23.3 percent of people 80 years or older receive home care services, while 12.9 percent live in a nursing home.[7] Home care includes medical assistance with drugs and wounds and also assistance with eating, dressing, and bathing etc. It is the task of municipal care managers to assess the service and care needs of applying elderly citizens. In general, a citizen who is awarded home care will get the right to use a certain amount of approved hours that are often specified in terms of content.

Privatization in the Swedish elderly care sector began in the late 1980s and took off during the 1990s. To begin with, municipalities primarily used public procurement as a way of outsourcing elderly care services, but the most common approach today is to outsource through a choice system. A small majority of Sweden's muncipalities have chosen to implement a choice system in accordance with the Free-Choice Act of 2009. In such a choice system, any provider that fulfills basic requirements can enter the market and compete for users. Providers can only compete with higher quality and not lower prices, since the price is set through a voucher that is collected by the provider based on the clients' choices. The private provider option is currently available in 146 municipalities, out of a total of 290 municipalities, and the overall market share of private providers (in terms of approved hours) is around 25 percent. In some municipalities, the voucher is based on the number of approved hours by care managers, while in other municipalities the voucher is based on the number of hours that is actually delivered. Actual digital measurement of delivered hours (logging in and out of the client's home) is the most reliable method of keeping track of private provider output and to compensate accordingly, although some municipalities also compensate according to what is simply

---

[6] Some criticism has been raised that care managers have been too restrictive in awarding care in nursing homes, and that many elderly with limited mobility suffer from feelings of loneliness in their homes.

[7] In the population 65 years and older, 8.5 percent receive home care, while 4.2 percent live in a nursing home. Data is provided by the Swedish National Board of Health and Welfare (Socialstyrelsen).

reported by the providers themselves. Digital measurement of delivered hours is also used by municipalities to keep track of their own productivity, measured as worker utilization. Such information can be used as a force for improvement in terms of cost efficiency, but also as a basis for calculating the level of hourly compensation to private providers.

3. Data

We have assembled a data set in which one observation is a "home care unit".[8] A home care unit is defined as having its own location office, and its own geographic area with clients to serve. All of the care units are municipal providers, and there are 172 such care units (in 15 municipalities) in our time use data set.

For most municipalities we observe all municipal care units. For two municipalities, however, we are missing a number of care unit observations: 16 and 23 respectively.[9] For most municipalities, the productivity measure refers to services delivered in September 2015. One municipality is observed in November 2015, one in October 2016, and one in February 2016.

The main care unit level variables in the data set are: worked hours, approved hours and delivered hours. *Worked hours* correspond to the hours that ultimately end up on the care workers' paychecks. The variable is extracted from the municipalities' wage payment systems and includes the hours of workers on permanent and temporary contracts. All hours at work are included: both overtime and time spent on administration and in meetings. Hours of vacation, sick leave or parental leave are not included. *Approved hours* correspond to the number of hours that clients are entitled to according to decisions taken by municipal care managers. The number of approved hours should be governed by the individual needs of each client. *Delivered hours* correspond to the actual number of hours that care workers spend with the clients. The 15 municipalities in our data set measure delivered hours using either a mobile phone app or a tag to log into a device (or a sticker) that is installed in the home of the clients. The variable delivered hours thus corresponds to the actual number of hours that care workers spend with the clients, from the time they log in to the time they log out from the client's home. Before digital measurement techniques were available, delivered hours were typically not measured at all or were in some cases registered using pen and paper, which is tedious and unreliable.

In Figure 1 we show a highly stylized example of a work day in home care services. Only the grey boxes, the time spent with the client, count as delivered hours. The more time workers spend in other activities, such as: planning, transport, breaks, and performing administrative tasks, the lower is the value of worker utilization.

---

[8] The data set has been collected and quality-assured by InRikta Analys AB.
[9] One of these two municipalities are dropped from most estimations because of missing values on control variables. Four municipalities have a missing value on productivity in one care unit, and one municipality has a missing value on productivity in two care units.

Figure 1. Time Use in Home Care Services

| Office
 Office
 Planning | Transport → | **Client**
 Home | Transport → | **Lunch**
 break | Transport → | **Client**
 Home | Transport → | **Office**
 Admin |

```
┌──────────┐           ┌──────────┐          ┌──────────┐           ┌──────────┐           ┌──────────┐
│  Office  │ Transport │  Client  │ Transport│  Lunch   │ Transport │  Client  │ Transport │  Office  │
│          │   ───►    │          │  ───►    │          │   ───►    │          │   ───►    │          │
│ Planning │           │   Home   │          │  break   │           │   Home   │           │  Admin   │
└──────────┘           └──────────┘          └──────────┘           └──────────┘           └──────────┘

                     Delivered hours                                Delivered hours

◄─────────────────────────────────────── Worked hours ───────────────────────────────────────►
```

We construct two variables by relating delivered hours to worked hours and to approved hours. Our measure of labor productivity, worker utilization, is the share of worked hours that is spent delivering services, and thus corresponds to the efficiency with which workers are utilized, for effective care service work or for other activities?[10] Service delivery is the share of approved hours that clients receive in the form of actual delivered services. Since approved hours should be determined by individual needs, service delivery can be interpreted as one dimension of service quality (rather than just the quantity of care).

We also have additional information about care units that we use to shed light on the determinants of productivity: number of clients, approved hours per client, and type of geographical area. A care unit can be of the area type "rural", "urban", "rural/urban" or "residential"[11]. In regressions we include a rural dummy that takes on value 1 if the care unit serves a purely rural area, and which takes on value 0 otherwise.

The time use data set is compiled exclusively for our purposes from municipalities that use digital measurement techniques. Our ex ante suspicions that this would imply a selected sample of municipalities turns out to be correct. The municipalities in the sample are larger and more urbanized than the average municipality. We propose that the municipalities are positively selected, i.e. we suspect that they have a higher level of productivity than non-participating municipalities, both because of the favorable demographical and geographical structure, but also because of the signaling value; municipalities that use digital time measurement are interpreted as goal-oriented.

In order to analyze the relationship between productivity and service quality we use survey data in which users were asked about their level of satisfaction with respect to home care services. This data set was collected by The National Board of Health and Welfare (Socialstyrelsen) in the spring of 2016. From this survey data set we choose three survey questions that are relevant for our purposes:

---

[10] For two municipalities we will make an adjustment to the measure of worker utilization in order to count twice the hours put in by those who work in pairs while serving the same client. "Pairwise work" is accounted for in all other municipalities. Since comparability can never be perfect, municipal level comparisons should be interpreted with a grain of salt.

[11] The "residential" area type is only registered in one municipality. This area should be considered as a densely populated area with residential housing, i.e. villas.

A. What is your opinion on how care workers execute their services?
B. Can you usually influence what times the care workers arrive?
C. Do care workers usually have enough time to provide services to you?

Clients can choose one out of five suggested answers to the questions above. On question A clients can respond: *Very well, pretty well, neither, pretty bad* or *very bad*. On questions B and C clients can respond: *always, often, sometimes, rarely* or *never*. We use the share of clients that choose either of the "favorable" answers (*very* or *pretty well*, *always* or *often*) as a measure of service quality in the following analyses.[12] We find matches in the survey data for 162 out of the 172 care units observations in the time use data. Most care units have a response rate of 60–80 percent (78 percent) and the average response rate is 67 percent.[13]

4. Describing Productivity

We now describe productivity, measured as worker utilization, and other variables in our data set. We also investigate the relationships between productivity and a number of observed structural and organizational variables on both municipal and care unit level. Average productivity in a home care unit is 58 percent, according to Table 1. In other words, care workers spend on average 58 percent of their worked time delivering services to the elderly in their homes. Average service delivery is 76 percent, i.e. 76 percent of the approved hours are in fact delivered to clients as home care services.[14] The average care unit serves 83 clients, and these clients are approved to receive on average 33 hours of services each month, equivalent to 8 hours a week. A small minority of care units (20 percent) deliver services in purely rural areas, while the remaining majority of care units deliver services in urban or mixed urban/rural areas.

Since we are relying on municipality fixed effects in the coming sections, we show in Table 1 three types of variation: the overall variation, the variation between municipalities and the variation within municipalities. Even though the between variation is larger, there is also considerable variation within municipalities, in terms of both worker utilization and service delivery. When it comes to the survey measures of satisfaction, we observe large shares of clients that answer favorably to the questions on care worker execution and time availability (88 and 83 percent). The share of clients that answer favorably to the question on timing influence is considerably smaller (60 percent).[15] As opposed to the case with worker utilization and service delivery, standard deviations for all three survey questions are larger within municipalities than between municipalities.

---

[12] It is not possible to analyze separately the most favorable answer since this value is not presented in the data if the number of respondents is too low.

[13] Response rates are only given in intervals of 20 percentage points and we assume that the average response rate in the group 60–80 percent is 70 percent, and so forth.

[14] Some care units display a service delivery that is higher than 100 %, i.e. they deliver more hours than clients can expect ex ante. The reason could be that some clients' care need drastically and unexpectedly increase before any adjustment can be made to approved hours.

[15] See Appendix A1 for full distributions.

Table 1. Care Unit Level Description

	Mean	Std. Dev. overall	Std. Dev. between	Std. Dev. within	Min	Max	*Obs.*
TIME USE DATA SET							
Worker utilization %	58.4	10.6	10.0	6.7	26.9	85.5	*172*
Service delivery %	75.7	17.7	15.7	11.2	40.5	131.3	*169*
Approved h./client	33.1	10.5	9.92	6.1	14.0	74.9	*169*
Clients	82.9	39.8	38.7	30.1	6.0	222	*175*
Approved h.	2698	1542	1408	1005	471	9135	*169*
Rural	0.2	0.4	0.3	0.3	0	1	*172*
SURVEY DATA ON SERVICE QUALITY							
A. Care worker execution %	88.4	7.2	4.3	6.3	55	100	*162*
B. Timing influence %	60.4	11.9	6.1	10.2	0	93	*161*
C. Time availability %	83.3	9.2	4.9	7.5	56	100	*162*

Note: The number of observations differ because of missing values, and because of failure to match all units with the survey data set. Worker utilization is defined as: delivered hours/worked hours, and service delivery is defined as: delivered hours/approved hours. "Non-rural" care units include "urban", "urban/rural" and "residential" care units. The percentages on survey questions refer to the client share that pick either of the two "favorable" answers out of five possible, see Section 3.

Maximum worker utilization is theoretically 100 percent since worker utilization is measured as the share of worked hours that is spent delivering services. In practice this is not a suitable benchmark since it is not possible to eliminate the time spent in transport, in training, or performing administrative tasks. We propose that a worker utilization of 75 percent could be considered "high", while 50 percent could be considered "low".[16] However, we would like to stress that the attainable level of productivity varies on a municipal (and care unit) level for a variety of structural reasons that are out of organizational control. Productivity is also affected by deliberate strategic choices by the municipality. While structural characteristics such as population density cannot be directly controlled, other aspects such as approved hours per client, care unit size and the duration of visits can be manipulated to a certain extent.

---

[16] This is our own interpretation, based on the fact that 75 and 50 percent are the highest and the lowest values used in calculation examples in a report by the Swedish Association of Local Authorities and Regions (SALAR 2009).

Table 2. Care Units, Clients and Municipalities categorized into Low, Medium and High Productivity

	Low<50%	Medium	High>75%
Number of care units	32	129	11
Rural	16	17	0
Non-rural	15	111	10
Share of care units	0.183	0.737	0.063
Number of clients	2032	11 301	986
Share of clients	0.142	0.789	0.069
Number of municipalities	3	12	0
Larger cities	0	6	0
Smaller cities	2	4	0
Commuter municipality to larger city	1	1	0
Commuter municipality to metropolitan area	0	1	0

Note: We lack information on geography in one municipality and therefore the numbers by geographical area do not add up. "Non-rural" care units include "urban", "urban/rural" and "residential" care units. The latest SALAR definitions are used to classify municipalities.

According to Table 2, almost a fifth of all care units in our data set can be classified as having low productivity (<50%). These low productivity units serve a 14 percent of all clients. 16 out of the 32 care units that have low productivity are servicing rural areas, which implies an overrepresentation of rural area care units in this group.[17] However, just as many low productivity care units are either purely urban or a mixture of urban and rural. The share of care units with high productivity (>75%) is 6.3 percent, and the group consists almost exclusively of urban care units. Overrepresentation of rural care units in the low productivity group, and of urban care units in the high productivity group, is expected given that lower (higher) client density increases (decreases) time in transport and therefore lowers (increases) productivity.

We now switch to municipal level comparisons. One of the municipalities in our sample is an extreme value in terms of population density. This municipality is a commuter municipality to Stockholm and has the highest population density of all municipalities in Sweden. The remaining municipalities in our sample are selected from a group of cities that share a somewhat similar structure in terms of urbanization, geography and size. Using the latest SALAR definitions, six municipalities are defined as "larger cities", six are defined as "smaller cities", two are defined as "commuter municipalities to larger cities", and one (the extreme value mentioned above) is classified as a "commuter municipality to a metropolitan area", see Table A1 in Appendix A2.[18]

Next we try to shed some light on the importance of municipality characteristics for productivity. Three of the 15 municipalities have low productivity, see Table 2. These low productivity municipalities are either "smaller cities" or "commuter municipalities to larger cities". No municipality has high productivity. Most municipalities (and care units for that matter) have medium productivity. Overall, the six "larger cities" have a somewhat higher

---

[17] The care unit with the lowest level of productivity (27 percent) is also the smallest (6 clients), and furthermore, this particular care unit exclusively serves the elderly on a small island of the coast of Sweden with 400 inhabitants.

[18] No municipalities from the groups "rural municipality", "commuter municipality to a smaller city", "rural municipality with tourism" or "low intensity commuter municipality to a larger city" participate in our study, and neither do any of the three metropolitan municipalities.

productivity (61 percent as weighted mean) than the six "smaller cities" (57 percent as weighted mean). One of the two municipalities with the highest productivity (71 percent) is the commuter municipality to Stockholm, with extreme values of population density and urbanization. The second municipality is a larger city with the second largest urbanization rate in the sample and the largest population.

Even though the simple municipal level comparison above leads us to the conclusion that municipal structural characteristics matter, we now show that this is not the full story. In Table 3 we compare two municipalities, one is a larger city in the north, and the other is a smaller city in the south. Even though group belonging differs, population and geographical characteristics do not differ greatly. The difference in population size is relatively small, both in the municipality as a whole, and in the urban area. The northern larger city has a lower population density overall but a higher urbanization rate. These relatively small differences do not motivate the large difference in overall productivity (26 percentage points overall, 30 percentage points in urban areas). Even the rural areas in the northern larger city have a higher productivity (61 percent) than the urban areas in the southern smaller city (40 percent). This simple comparison shows that the variation in productivity cannot be entirely explained by structural factors or differences between municipalities that are out of their control.

Table 3. Comparison Between Two Similar Municipalities

	Northern city	Southern city
PRODUCTIVITY MEASURES		
Worker utilization %	67.7	41.0
Worker utilization rural areas %	60.5	43.2
Worker utilization urban areas %	69.4	39.9
CHARACTERISTICS		
Population	76 088	65 380
Population urban area	43 574	36 477
Population density (pop./km^2)	36.3	62.7
Urbanization rate %	90	83

Note: See Table A1 in Appendix A2 for information on all municipalities. Urbanization rate is the share of the population that lives in an urban area. Municipal/area level worker utilization is a weighted mean.

We now analyze the relationship between structural municipal characteristics on a more fine-grained level. In Figure 2 we show the municipal level relationship between worker utilization and population density. The figure shows only a very weak negative relationship between population density and productivity. The most densely populated municipality in our sample is not included in Figure 2 since its value on population density is 17 times higher than the highest value in the figure. If we include the extreme value, the relationship becomes positive, se Figure A4 in Appendix A2. In Figure 3, there is a slight positive relationship between population size and productivity. One advantage of larger municipalities is that they have a larger pool of competent individuals from which to select into municipality leadership. Figure 4 shows a positive relationship between the urbanization rate and productivity.

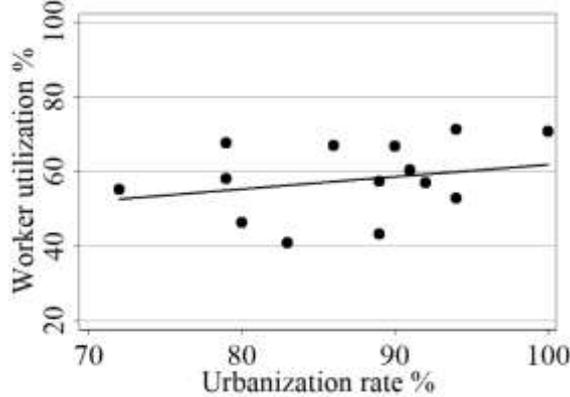Figure 2: Productivity and Population Density
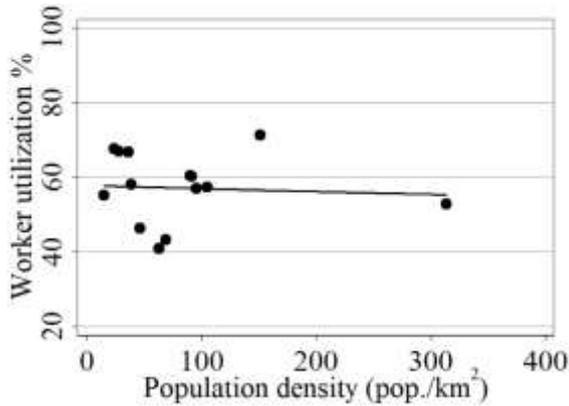
Note: Each dot is represents one municipality. Worker utilization is a weighted average. One municipality (commuter municipality to Stockholm) has been exluded from the figure as it is a very extreme value.

Figure 3: Productivity and Population Size
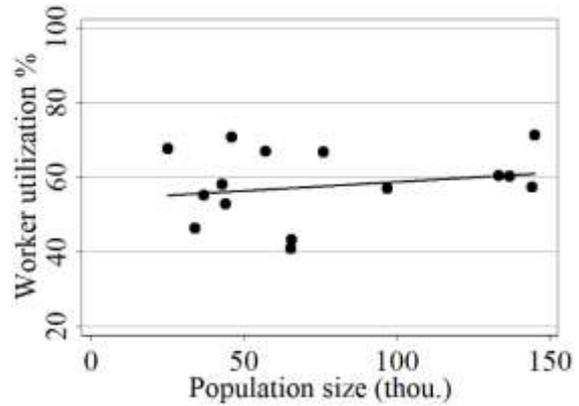
Note: Each dot is represents one municipality. Worker utilization is a weighted average. Population size is shown in the thousands.

Figure 4. Productivity and Urbanization Rate

Note: Each dot is represents one municipality. Worker utilization is a weighted average. Urbanization rate is defined as the share of the population that lives in an urban area.

4.1 Determinants of Productivity: Regressions

We now perform regressions on care unit level in order to more formally investigate the relationship between structural characteristics and worker utilization at the care unit level. We examine the role of scale in two ways: care unit size and the care intensity of clients. Care unit size is represented by the number of clients, and care intensity is the number of approved hours per client. With more care intensive clients, each visit is expected to be longer, which decreases time for transport and increases worker utilization. Larger units could potentially be better at using workers efficiently, because of a larger pool of workers, and they could also have better managers. We include a dummy that takes on value 1 for purely rural areas, and 0 otherwise. The coefficient on the rural dummy is expected to be negative because of increased transport time between clients in rural areas.

Table 4. Care Unit Level Determinants of Productivity

	(1)	(2)	(3)
Approved h./client	-0.017	0.194**	0.178**
	(0.107)	(0.068)	(0.077)
Number of clients	0.042	-0.022	-0.042**
	(0.042)	(0.018)	(0.018)
Rural dummy	-8.311***	-4.785*	-6.122***
	(2.130)	(2.221)	(1.851)
Municipality fixed effect		✓	✓
Weights			✓
Adjusted R^2	0.14	0.64	0.69
Observations	*163*	*163*	*163*

Note: Outcome variable is worker utilization. Two municipalities are dropped from the estimations: one that lacks information about area type, and one that lacks information on approved hours. "Non-rural" care units include "urban", "urban/rural" and "residential" care units. In column (3) care units are weighted by size through the number of approved hours. Standard errors are clustered at municipal level.***p<0.01, **p<0.05, *p<0.1.

We show the results from three regression models in Table 4, where we also vary the inclusion of fixed effects and weights by the number of approved hours on care unit level. The negative coefficient on the rural dummy lands between -4.8 and -6.1 percentage points in the fixed effects regressions, which accounts for around half a standard deviation in worker utilization. We also find that hours per client is positively related to worker utilization when including municipality fixed effects. A standard deviation increase in approved hours per client of 10 hours is related to an increase in productivity of 1.9 percentage points, using the largest coefficient in Column (2). The relationship is intuitive since longer visits reduce the costly travel time between clients.

The results in Table 4 suggest a couple of things related to the problem of "cream skimming"; when private providers selecting the most profitable clients. Many municipalities allow private providers to choose which areas within the municipality to serve. In these particular municipalities we expect providers to primarily choose to serve in urban areas unless there is a generous enough rural mark-up in the compensation system. Additionally, contrary to the situation for health insurance, sicker and more needy home care clients seem to be more profitable to serve. Therefore, to the extent that home care providers are able to select individual clients, they have incentives to pick the urban ones, while lacking incentives to pick the healthiest ones.

This far we have shown results that are in line with expectations. The result for number of clients is however not in line with the expected importance of scale. The negative result in Column (3) is not robust to the exclusion of weights. According to Column (3) a standard deviation increase in the number of clients of around 40 clients would lead to a decrease in productivity of around 1.7 percentage points. The coefficient sizes for care unit size and care intensity are definitely not negligible but they are not very large either. Furthermore, coefficients are not very precisely estimated. The coefficient on the rural dummy in Column (3) is economically important, but the 95 % CI is wide [-10.16, -2.09].

4.2 Determinants of Productivity: Compensation System

Within a choice system with private providers, or in a purchaser-provider system with only public providers, the municipality needs to select a system for compensation to the provider. In home care for the elderly, it is most common to compensate providers either according to delivered hours (measured digitally or as reported by the provider) or according to approved hours (as determined by the care manager). Among our municipalities, nine municipalities compensate according to delivered hours, and four compensate according to approved hours. There is a substantial difference in productivity between these two groups of municipalities: compensation for delivered hours yields a productivity of 62.5 percent, while compensation for approved hours yields a productivity of 51.7 percent. Although we cannot draw any causal conclusions with such a limited sample, this difference nonetheless suggests that compensation that is based on actual delivery could be fruitful for delivery in itself and subsequently for productivity. A system that awards compensation no matter whether hours are actually delivered could contribute to weakened incentives to deliver services and spend time with clients. We want to make clear, however, that what we present here is just suggestive evidence, and that a more extensive municipal data set is needed in order to more fully study the role of the compensation system.

5. Relationship Between Productivity and Quality

We examine the relationship between quality in home care services using two kinds of quality measures; a client satisfaction survey, and our service delivery measure. While the client satisfaction data capture clients' subjective views on how well services are delivered, the service delivery measure is an objective quality measure that captures the extent of actual delivery of services in relation to what clients are entitled to.

5.1 Productivity and Service Quality

As mentioned in the introduction, there are different perspectives on the relationship between productivity and service quality. A negative relationship between productivity and service quality is predicted by the *dysfunctional* and the *microeconomic view*. In the *dysfunctional view*, the negative result is a function of a boundedly rational decision-making system where good data on service quality is hard to find. In the *microeconomic view* providers choose rationally among different combinations of productivity and service quality. In both views, there is a trade-off between service quality and productivity since production is already optimized according to standard microeconomic theory. An excessive preoccupation with productivity could in this case lead to lower service quality, for instance because tighter schedules wears care workers out, which ultimately could lead to badly executed services. A tighter schedule could also be demotivating by diminishing the professional latitude in providing care services according to day-to-day needs.

A positive relationship between productivity and service quality is consistent with the *managerial view*. Higher productivity is seen as the result of better management practices which – in line with Bloom *et al.* (2015) – leave room for cheaper, more and better services. However, it is also possible that higher productivity is used only to reduce costs rather than to provide more and better services, which would imply a zero relationship between productivity and service quality.

We match our time use data set with a survey data set that measures client satisfaction in several dimensions of home care. From this data set we have selected three survey questions that are relevant for our purposes:

A. What is your opinion on how care workers execute their services? (care worker execution)
B. Can you usually influence what times the care workers arrive? (timing influence)
C. Do care workers usually have enough time to provide services to you? (time availability)

Each of the three survey variables takes on values from 0 to 100, which signifies the share of clients that gave a favorable answer.[19]

Figure 5. Care Worker Execution | Figure 6. Timing Influence
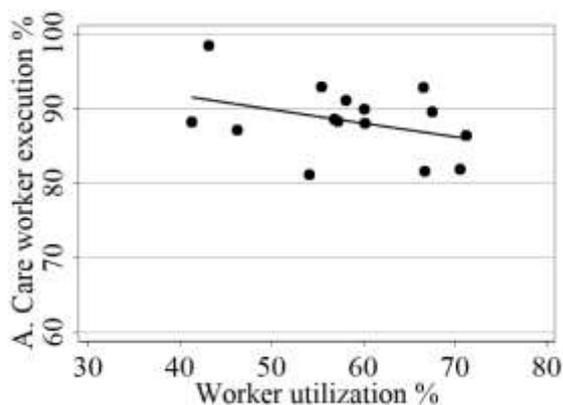
Figure 7. Time availability
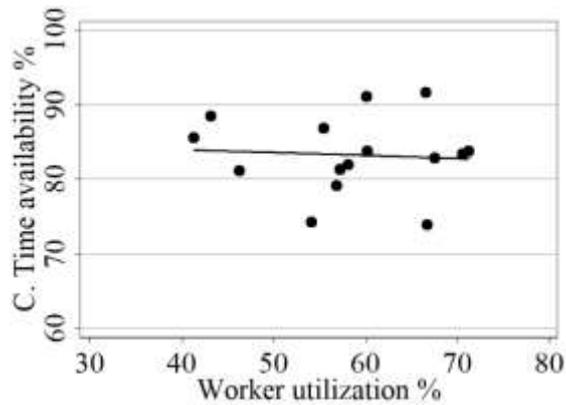
Note: Each dot represents one municipality.
Municipal level values are weighted vaules.

The municipal level relationships between answers to the three survey questions and productivity are shown in Figures 5–7. There is negative relationship in Figure 5, but no relationship in Figure 6 or 7. Municipal level correlations thus indicate that higher productivity is related to lower client satisfaction with regard to care worker execution, although the slope of the fitted line in Figure 5 is not very steep. However, we cannot draw sharp conclusions about causal relationships based on municipal level variation in such a small sample. There could be confounding factors at the municipal level that affects productivity in a positive way and service quality in a negative way. As an example, municipalities that are under financial pressure to save costs will prioritize high productivity and will also cut back on other investments that support service quality.

In Table 5 we perform a more sophisticated test of the relationship between service quality and productivity by using care unit level data and including municipality fixed effects. It turns out that none of the coefficients is statistically significant, although the coefficients on Question A (care worker execution) comes out as consistently negative. The point estimate of -0.064 for Question A in Column (4) implies that a 10 percentage point increase in productivity decreases the share of clients with a favorable view on care worker execution by 0.64 percentage points, a small estimate. The corresponding municipal level coefficient with respect to Question A (see Figure 5) is somewhat larger at -0.185. These results do not offer (strong) support for the idea that higher worker utilization comes at the expense of lower service quality in the eyes of the clients, but they do it indicate the importance of further research, especially with regard to worker execution.

Table 5. Care Unit Level Regressions of Productivity on Service Quality

	(1)	(2)	(3)	(4)
OUTCOME VARIABLE: A. WORKER EXECUTION				
Worker utilization	-0.094	-0.075	-0.024	-0.064
	(0.092)	(0.098)	(0.077)	(0.088)
OUTCOME VARIABLE: B. TIMING INFLUENCE				
Worker utilization	0.073	0.008	0.065	-0.057
	(0.143)	(0.156)	(0.200)	(0.157)
OUTCOME VARIABLE: C. TIME SUFFICIENCY				
Worker utilization	-0.008	-0.040	0.029	-0.005
	(0.110)	(0.111)	(0.074)	(0.090)
Controls		✓	✓	✓
Fixed effects			✓	✓
Weights				✓
Observations	*162*	*154*	*154*	*154*

Note: Two municipalities are dropped from the estimations that includes control variables: one that lacks information about area type, and one that lacks information on approved hours. Outcome variable are defined as the share of clients that answer favorably to each survey question separately. Number of observations differ because of missing variables on controls. Controls are the following: number of clients, approved hours per client and rural dummy. In column (4) care units are weighted with the number of approved hours. Standard errors are clustered at municipal level. ***p<0.01, **p<0.05, *p<0.1.

5.2 Productivity and Service Delivery

While it is of great importance that the service hours that clients receive are of high quality it is also crucial that the clients receive the hours they need in the first place. Our measure of service delivery (the share of approved hours that are delivered) can be interpreted as a dimension of quality since clients should benefit from receiving a larger share of the hours approved to them since this assessment is based on their individual needs.

A complication is that different municipalities could use different strategies when assessing care needs. Some municipalities might choose to approve additional hours as a safety margin in case care needs increase. Other municipalities might approve exactly the amount of hours that the client is expected to need, or even fewer hours than that in order to control the overall expenditure level. These different approaches can generate municipal differences in service delivery that cannot be interpreted as quality differences. If there are such differences between municipalities, we would expect to see a negative relationship between service delivery and approved hours per client, which is also what we see in our data, see Figure 8.

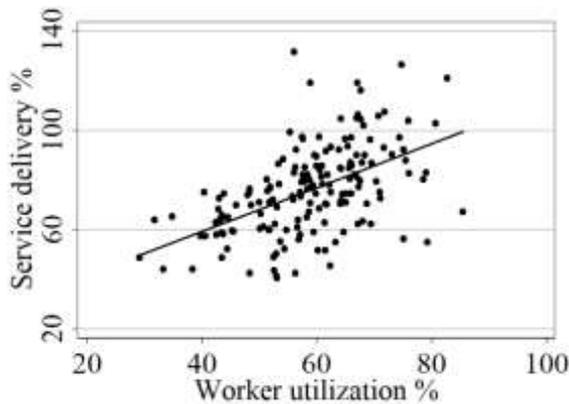Figure 8. Service delivery and approved hours
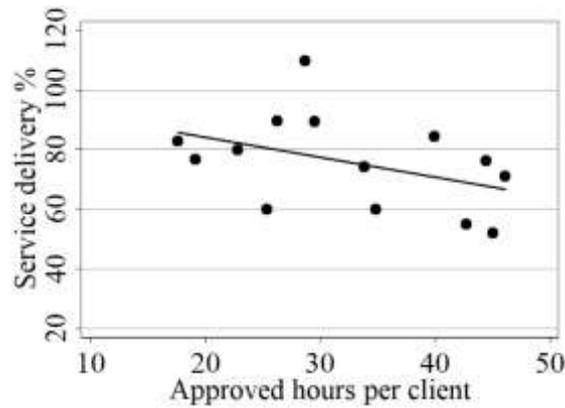
A relationship between care worker utilization and service delivery at the care unit level would on the other hand indicate that the organization of work, including the effort put in by care workers, has consequences for the welfare of clients. The relationship between productivity and service delivery is shown in Figure 9 and 10. Clearly the relationship is positive at the care unit level, both overall and within municipalities; clients that are served by more productive units receive more of the hours that they are entitled to. The relationship within municipalities is especially relevant since municipal differences in care need assessment are held constant.

Note in passing, that one would not observe a positive relationship between worker utilization and service delivery in an "ideal world" of home care production. In an ideal world, service delivery would be close to 100 percent (since the needs of clients would be almost perfectly predicted) and worker utilization would be determined by structural factors such as population density and care need, as well as by organizational factors such as necessary administration and training. Although it is perhaps unsurprising that Sweden does not constitute an ideal world of home care production, the comparison demonstrates that the positive relationship between worker utilization and service delivery should not be written off as self-evident.

Figure 9: Overall Care Unit Variation   Figure 10: Variation Within Muncipalities
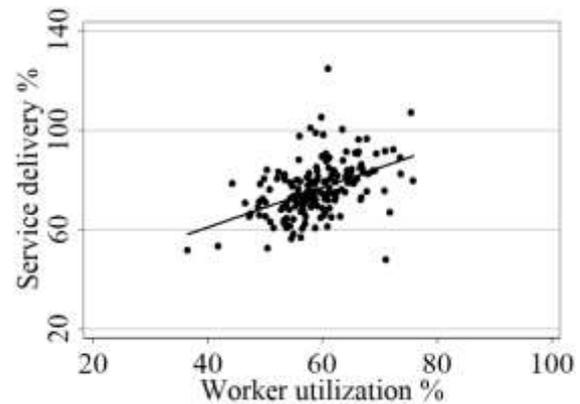
18

The positive relationship between worker utilization and service delivery might be driven primarily by care unit characteristics or by the demand of clients. To start with, the relationship could be generated by differences in inherent productivity at the care unit level. Such differences could be due to "bad planning", for instance that the unit leader does not provide sufficient information to the other workers, give them too vague instructions or exercise a demoralizing leadership. It could also be the case that individual care workers at the unit are less able or willing to put in effort. A care unit with a good leader and hard-working staff will deliver what is planned and also be better at handling unpredictable variations in service demand from clients. We refer to this as the *care unit mechanism* since the relationship is generated by characteristics of the care units.

Alternatively, the positive relationship between worker utilization and service delivery could reflect unpredictable realizations in the need for care. A problem with home care is that the daily care plan will be imperfect as the clients sometimes decline service on short notice. For instance, a client might have gotten help from a relative, might be absent, or might simply not be interested in getting help at the time of the visit. Since such changes in demand are more or less unpredictable, it will not be possible to reduce the amount of worked hours accordingly. In consequence, some unlucky care units might experience low service delivery and low worker utilization. Notably, this interpretation implies that it is non-trivial to redistribute time to other clients when space suddenly appear in the schedule. This might be the case if many clients do not appreciate unannounced visits, or visits that deviate substantially from the agreed time. We refer to this as the *client mechanism* since the relationship is generated by the needs and decisions of clients. An important difference between the *care unit mechanism* and the *client mechanism* is that the positive relationship affects client welfare negatively only according to the *care unit mechanism*.

We examine which of these mechanisms, the client or the care unit mechanism, that is more likely to drive the positive relationship between service delivery and worker utilization by estimating two interaction models. We investigate the care unit mechanism by comparing municipalities with different compensation systems. We propose that the room for bad organization and slack is more limited in care units in municipalities that compensate according to delivered hours. When compensating according to delivered hours care workers that would otherwise tend to steal time from clients are incentivized and more strongly encouraged by management to deliver all the planned hours. We thus expect the positive relationship between service delivery and worker utilization to be stronger in municipalities that compensate according to approved hours if organizational and worker slack is driving the relationship.

We propose that the client mechanism appears only if generosity in care planning is high, i.e. there is a tendency to plan for a high delivery of hours with a subsequent risk that several of these hours will not be needed by clients. While this implies a downside margin that can easily be used, there is less room to adjust upwards; to increase service delivery above what has been planned. Since we do not observe planning generosity at the care unit level we will use the number of approved hours per client at the municipal level as an approximation of planning

generosity in the municipality as a whole.[20] In municipalities with a stricter rationing of hours; where clients are approved the exact amount of hours they need and where care planners are more restrictive with the amount of hours included in planning, there is less room to generate a relationship between service delivery and worker utilization since clients are more likely to use all planned hours. In short, the client mechanism will appear primarily in municipalities that are generous in approving hours to clients and we therefore expect the positive relationship between service delivery and worker utilization to be stronger in such municipalities.

Table 6: Interaction model: Relationship Between Worker Utilization and Service Delivery

	(1)	(2)	(3)	(4)
INTERACTION MODEL 1: COMPENSATION SYSTEM				
Worker utilization	0.946***	1.028***	0.796***	0.657**
	(0.284)	(0.282)	(0.200)	(0.247)
Interaction variable: Approved	0.177	0.264	0.447	0.565*
	(0.361)	(0.307)	(0.348)	(0.260)
INTERACTION MODEL 2: PLANNING GENEROSITY				
Worker utilization	0.932***	1.201***	1.067***	0.896**
	(0.243)	(0.278)	(0.226)	(0.421)
Interaction variable: Generous	-0.302	-0.349	-0.319	-0.174***
	(0.282)	(0.283)	(0.241)	(0.426)
Controls		✓	✓	✓
Municipality fixed effects			✓	✓
Weights				✓
Observations	*166*	*163*	*163*	*163*

Note: Outcome variable is service delivery. Two municipalities are dropped from the estimations that includes control variables: one that lacks information about area type, and one that lacks information on approved hours. Controls are the following: number of clients, approved hours per client and rural dummy. In column (4) care units are weighted with the number of approved hours. Standard errors in parenthesis are clustered on municipal level.***$p<0.01$, **$p<0.05$, *$p<0.1$.

The results from the interaction models are shown in Table 6. In the upper panel we find that the coefficient on the variable Approved (interaction between worker utilization and a dummy if the municipality compensates approved hours) is positive, which is in line with expectations if the relationship is generated by organizational aspects or worker behavior. In the lower panel we investigate the client mechanism and expect a positive coefficient on the interaction variable Generous (interaction between worker utilization and a dummy that takes on value 1 if the municipality is above the median in terms of approved hours per client). Instead of a positive coefficient we get a consistently negative one, which does not offer support for the hypothesis that clients' needs and decisions to unexpectedly decline services drive the mechanism between service delivery and worker utilization.

---

[20] Another way of phrasing it is to say that it reflects the municipal level of risk taking with respect to productivity decreases (care unit level) and cost increases (municipal level, if clients demand more of the hours that are approved).

6. Summary and discussion

Increasing productivity in the provision of public services is important but difficult to achieve. Elderly care will demand an increasing share of the work force in developed countries as the population becomes grayer and grayer. Providers of elderly care, such as Swedish municipalities, face a formidable challenge of how to utilize workers efficiently without sacrificing important dimensions of service quality. The introduction of digital measurement is promising in this perspective since it might promote productivity by presenting managers with actionable data on service production.

We study the relationship between labor productivity and service quality in home care for the elderly, a high-contact service, using a narrow, digitally collected, measure of productivity that we refer to as worker utilization; the share of the total work time that is spent with clients. The clarity, reliability and transparency of this measure constitute an improvement on typical measures used to analyze productivity in public services and elderly care.

The time use measure expose large variations in worker utilization among municipalities that are similar in terms of geography and population characteristics. Although structural characteristics seem to account for some of the variation in productivity, this is not the whole story. Several municipalities display levels of productivity from which there is obvious room for improvement. At the care unit level, almost a fifth of all care units in our data display a low level of labor productivity (<50 percent) and 6 percent of the units display a high level of labor productivity (>75 percent). Our back-of-the-envelope calculations suggest that increasing labor productivity from 40 percent to 60 percent could save the average municipality in our sample up to SEK 47 million annually, equal to 30 percent of total costs. A notable albeit suggestive piece of evidence is that municipalities that compensate providers according to (ex post) delivered hours instead of (ex ante) approved hours have a higher level of worker utilization. In line with expectations, rural care units tend to have lower productivity whereas care units with more care intensive clients tend to have higher productivity.

Our analysis does not point at a negative trade-off between productivity and service quality. Such a trade-off would be expected if production was already optimized (the *microeconomic view*) or suffered from an excessive focus on productivity (the *dysfunctional view*). Instead, our findings are consistent with the *managerial view,* according to which productivity improvements are explained by good management and therefore need not come at the expense of clients. We find that clients served by more productive – and presumably better managed – units receive a larger share of the hours that they are entitled to. At the same time, the results that higher productivity is not associated with more satisfied clients suggests that the reduced costs per hour are the main benefit of higher productivity. In any case, the relationship between productivity and service quality is a question that should be addressed in future research. For instance, we found a negative correlation between productivity and one of the measure of user satisfaction (of care worker execution) at the municipal level. Examining this correlation with data from additional municipalities could possibly reveal a richer productivity picture.

The sample of municipalities is a main limitation of the study. Since digital registration of visits has not been adopted by all Swedish municipalities, we observe only care units in a selected group of municipalities.[21] It would not come as a surprise if worker utilization was lower in the unobserved municipalities, since our municipalities are relatively large and urbanized, but also because their participation might reveal an awareness of the issues at stake. In any case, we hope to demonstrate how the digitalization of home care produces new data that advance the prospects of measuring and improving productivity and service delivery.

The introduction of digital measurement in home care can also be seen in the light of *New Public Management*. The digital logs that enable detailed productivity measurement can also be interpreted as an apparatus of monitoring and control. To the extent that care workers perceive this as distrust, digital measurement could harm professional norms and *public sector motivation* (Dixit 2002; Francois 2000; Falk and Kosfeld 2006). On the other hand, digitalization could help alleviate an administrative burden that has been emphasized as an increasing problem in the public sector. A study on the actual introduction of digital measurement of time use would therefore be welcome in future research.

Digitalization opens new avenues for research. Hopefully we have managed to portray one such promising avenue regarding public sector productivity by providing some suggestive evidence on the correlates of productivity in home care. While home care is an evident application, our investigation could illuminate other public services too. Worker utilization is a general productivity measure that should be informative of labor productivity in health care and long-term care generally.

---

[21] About half of all municipalities use digital registration in home care for the elderly.

References

Arnek, Magnus, Mats Bergman, Harald Edquist, Lars Hultkrantz, Sofia Lundberg and Mikael Svensson. 2013. "Den offentliga sektorn – en antologi om att mäta produktivitet och prestationer." Report to the Expert Group on Public Economics 2013:8.

Arnek, Magnus, Tore Melin, and Anders Norrlid. "Mer än tur i struktur – en ESO-rapport om kommunal effektivitet." Report to the Expert Group on Public Economics 2016:6.

Atkinson Review. 2005. *Final report: Measurement of Government Output and Productivity for the National Accounts*, Palgrave McMillan, Basingstoke.

Baumol, William J. 1993. "Health care, education and the cost disease: A looming crisis for public choice." *Public Choice* 77 (1): 17–28.

Baumol, William J. 1967. "Macroeconomics of unbalanced growth: The anatomy of urban crisis." *American Economic Review* 57 (3): 187–249.

Bergman, Mats A., Per Johansson, Sofia Lundberg, Giancarlo Spagnolo. 2016. "Privatization and quality: Evidence from elderly care in Sweden." *Journal of Health Economics* 49: 109–119.

Bloom, Nicholas, Carol Propper, Stephan Seiler, and John Van Reenen, 2015. The impact of competition on management quality: Evidence from public hospitals. *Review of Economic Studies*, 82 (2): 457–489.

Burda, Michael, Katie R. Genadek, and Daniel S. Hamermesh. 2016. "Not working at work: Loafing, unemployment and labor productivity." NBER Working Paper No. 21923, National Bureau of Economic Research.

Charnes, Abraham, William W. Cooper, and Edwardo Rhodes. 1978. "Measuring the efficiency of decision making units." *European Journal of Operational Research* 2 (6): 429–444.

Dixit, Avinash. 2002. "Incentives and organizations in the public sector: An interpretative review." *The Journal of Human Resources* 37 (4): 696–727.

European Commission. 2015. *Excellent Innovation for Ageing, a European guide – Reference Sites.*

Erlandsson, Sara, Palle Storm, Anneli Stranz, Marta Szebehely, and Gun-Britt Trydegård. 2013. "Marketising trends in Swedish eldercare: competition, choice and calls for stricter regulation." in *Marketisation in Nordic eldercare: a research report on legislation, oversight, extent and consequences* edited by Gabrielle Meagher and Marta Szebehely, Stockholm Studies in Social Work 30.

Falk, Armin, and Michael Kosfeld. 2006. "The hidden costs of control." *The American Economic Review* 96 (5): 1611–1630.

Francois, Patrick. 2000. "'Public service motivation' as an argument for government provision." *Journal of Public Economics* 78 (3): 275–299.

Gaynor, Martin, Rodrigo Moreno-Serra, and Carol Propper. 2013. "Death by market power: Reform, competition, and patient outcomes in the National Health Service." *American Economic Journal: Economic Policy* 5 (4): 134–166.

Gaynor, Martin, Carol Propper, and Stephan Seiler. 2016. "Free to choose? Reform, choice, and consideration sets in the English National Health Service." *American Economic Review,* 106 (11): 3521–3557.

Glenngård, Anna Häger. 2013. "Productivity and patient satisfaction in primary care – Conflicting or compatible goals?" *Health Policy* 111: 157–165.

Hamermesh, Daniel. 1990. "Shirking or productive schmoozing: Wages and the allocation of time at work." *Industrial and Labor Relations Review*, 43: 121S–133S.

Karlsson, Andreas, Paula Blomqvist, and Ulrika Winblad. 2017. "Do public nursing home care providers deliver higher quality than private providers? Evidence from Sweden." *BMC health services research* 17 (1): 487.

Murray, Richard. 2010. "Measuring output from the public sector: A critical examination of the Atkinson review." *Review of Income and Wealth* 56 (2): 413–423.

NBHW. 2012. "Kommunal eller enskild regi, spelar det någon roll?"

OECD. 2016. *OECD Labour Force Statistics 2015,* OECD Publishing.

OECD. 2016. "Innovation for an ageing society." *OECD Science, Technology and innovation Outlook 2016.*

Office for National Statistics. 2016. "Data Set: Growth rates and indices for total public service output, inputs and productivity: Table 1." https://www.ons.gov.uk/economy/economicoutputandproductivity/publicservicesproductivity/datasets/growthratesandindicesfortotalpublicserviceoutputinputsandproductivitytable1

Oliver, Rogelio, and John D. Sterman. 2001. "Cutting corners and working overtime: Quality erosion in the service industry." *Management Science* 47 (7): 894-914.

Parasuraman A., Valerie A. Zeithaml, and Leonard L. Berry. 1985. "A conceptual model of service quality and its implications for future research." *Journal of Marketing* 49 (4): 41-50.

SALAR. 2009. "Val av ersättningsmodell och beräkning av ersättningsnivå."

Simpson, Helen. 2008. "Productivity in public services." *Journal of Economic Surveys* 23 (2): 250–276.

Stolt, Ragnar, Paula Blomqvist, and Ulrika Winblad. 2011. "Privatization of social services: Quality differences in Swedish elderly care." *Social Science & Medicine*, 72, 560–567.

Ulmanen, Petra. 2012. "Working daughters: A blind spot in Swedish eldercare policy." *Social Policy* 20 (1): 65–87.

Appendices
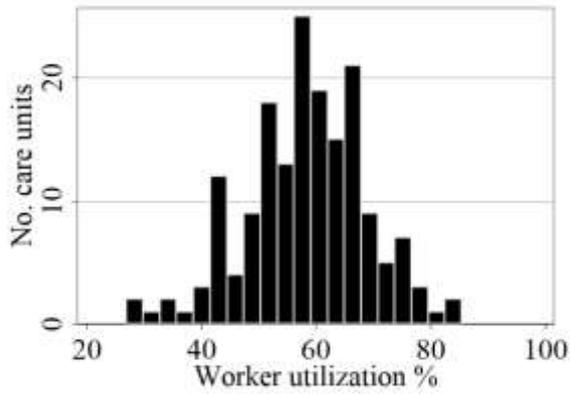
Appendix A1. Full Distributions

Figure A1: Distribution of Worker Utilization
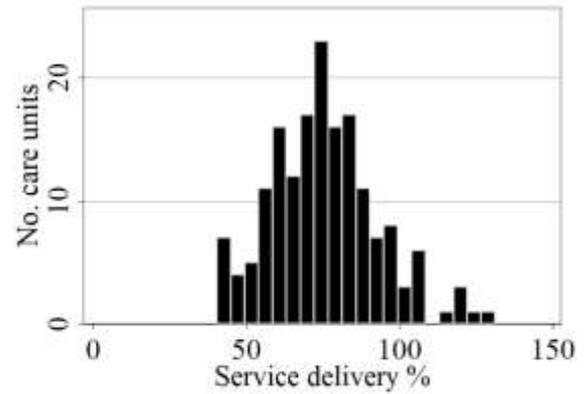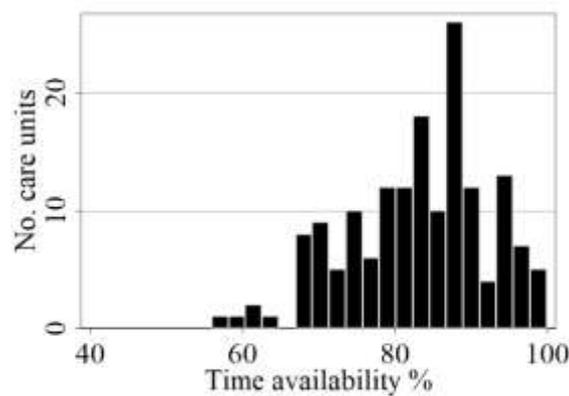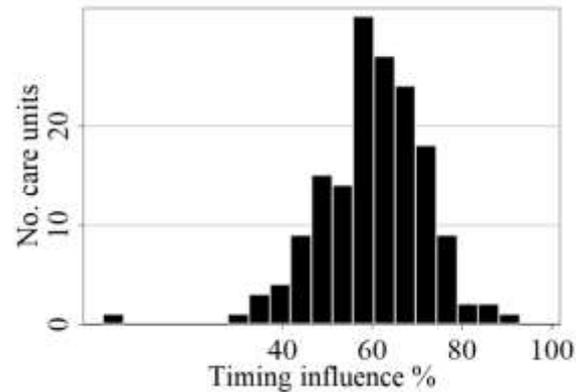
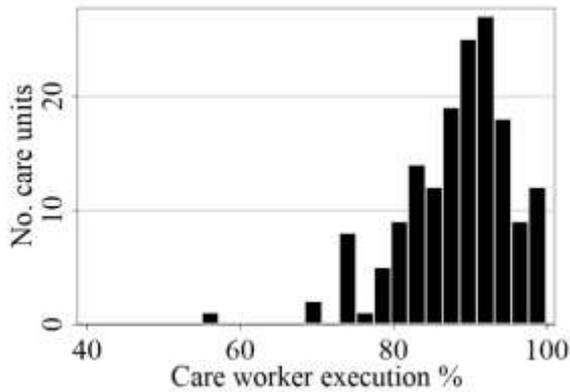Figure A2: Distribution of Service Delivery

Figure A3: Distributions of Client Survey Questions (Share of Favorable Answers)

Appendix A2. Municipalities in the Sample and their Structural Characteristics

Table A1. Municipal Characteristics and Types

	Worker Utilitiz. %	Density pop/km²	Density quartile	Pop. Thou.	Pop. quartile	Urb. %	Urb. quartile
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Com. w. metropolitan area	71	5308	4Q	46	4Q	100	4Q
Larger city 1	60	92	4Q	137	4Q	91	4Q
Larger city 2	60	90	4Q	133	4Q	91	4Q
Larger city 3	57	96	4Q	97	4Q	92	4Q
Larger city 4	57	105	4Q	144	4Q	89	4Q
Larger city 5	71	152	4Q	145	4Q	94	4Q
Larger city 6	67	36	3Q	76	4Q	90	4Q
Com. w. larger city 1	46	46	3Q	34	4Q	80	3Q
Com. w. larger city 2	52	313	4Q	44	4Q	94	4Q
Smaller city 1	41	63	3Q	65	4Q	83	3Q
Smaller city 2	58	39	3Q	43	4Q	79	3Q
Smaller city 3	55	15	2Q	367	4Q	72	2Q
Smaller city 4	68	24	2Q	25	3Q	79	3Q
Smaller city 5	67	28	3Q	57	4Q	86	3Q
Smaller city 6	43	69	3Q	66	4Q	89	4Q

Note: The column with quartiles refer to the position in the full municipal distribution. Urbanization rate: the share of the population that live in an urban area.

Figure A4. Relationship between Productivity and Population Density (including metropolitan municipality)
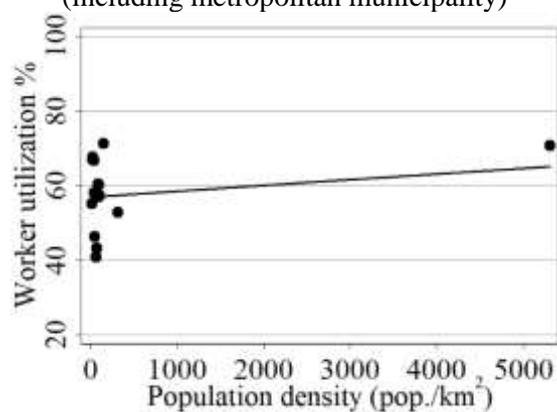
Appendix A3. Correlation with earlier used productivity measures

Earlier used measures when analyzing productivity in Swedish home care, and in the productivity literature in general, is cost-per-client. In Figure A5, we show the municipal level correlation between our productivity measure (worker utilization) and cost-per-client in home care. The relationship shown is negative, which is expected given that both variables capture some relevant aspects of overall productivity; a lower worker utilization should lead to higher costs-per-client. One weakness of the earlier used measure (cost-per-client) is that it includes also variation in the number of hours clients receive, which is partly determined by differences in ambitions and generosity. A higher cost-per-client in one municipality could be the result of approving more hours to a client that with equal needs would receive less hours in a low cost-per-client municipality. These differences should not be interpreted as productivity differences. In Figure A5 it is clear that several municipalities that display a similar worker utilization on a medium high level (around 65–70 percent) would be judged as having very different levels of productivity according to the cost-per-client measure.

Figure A5: Correlation with cost-per-client
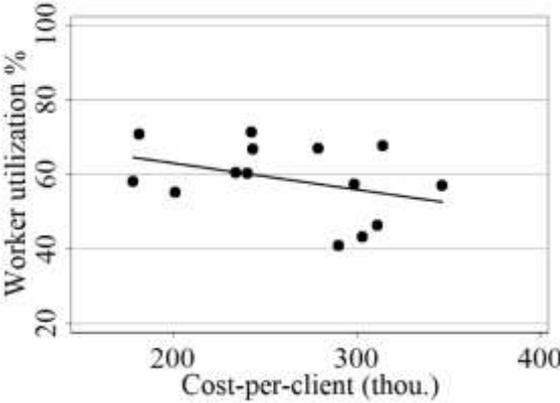
Note: Each dot represents one municipality. Weighted values.
One municipality is dropped that lacks information on cost-per-client.