Costs in Swedish Public Transport

An analysis of cost drivers and cost efficiency in public transport contracts

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“Wha... What is a weekend?"

Violet Crawley, Dowager Countess of Grantham. Downton Abbey.
Abstract

During the last seven years, the total cost for Swedish public transport provision has increased by over 30 percent in real terms according to figures from the government agency Transport Analysis. A similar pattern is found if considering a longer time span. Part of the cost increase can be attributed to an increased supply, and part is due to price increases on input factors that are measured by an industry index produced by the public transport industry. The fact that about half of the costs in Swedish public transport are covered by public funds calls for responsibility in how these funds are used, and this means that information about cost drivers and cost efficiency is necessary. The lack of information about these factors in the Swedish public transport sector is the main motivation for the two papers included in this thesis.

In this cover essay, the developments over the last decades in Swedish public transport are described, and there is a focus on the last ten years with the Doubling Project and the market in 2012. As mentioned, the costs as a whole, as well as per unit costs such as cost per vehicle kilometer, have increased in real terms since 2007. Even though parts of the cost increase can be attributed to an increased supply or the price of input factors, this development might be problematic for at least two reasons. First, the ambition of the industry to double the number of travelers by the year 2020 seems to have resulted in a supply increase around year 2010 and a similar increase in the number of boardings. However, the cost per vehicle kilometer and cost per boarding have both increased since then, which can bring into question whether the supply increases have been made at the right places and to the proper extent to have the desired effect on travel. Second, it is not clear whether a price increase for input factors can be viewed as an “acceptable” explanation for the cost increase. To the extent that the Public Transport Authority (PTA) or operator can affect the price of input factors such as buses (detailed or environmental requirements, etc.) or labor (demands on take-over of previous staff), an endogenous relationship is possible, which could disguise these potentially cost-driving factors as general price increases. At the end of this essay, a discussion about the lack of publicly available data highlights the
non-compliance with EU regulations related to this. More data resources, perhaps with open access, would enable more comparisons between contractual forms, PTAs, and operators, which would provide examples of good and poor solutions and concepts in the industry and would have the potential to ensure better use of public funds.

Below is a summary over the two paper included in this licentiate thesis.

**Papper I** - “Costs for Swedish Public Transport Authorities” - uses contract-level data for the year 2012 and econometric methodology to investigate how contract factors affect costs for bus contracts. A theoretical framework is established to show some of the cost mechanisms that are at work in the two most popular contractual forms in Sweden, and the paper provides some insights into what results to expect from the empirical analysis. The most important results from the econometric analysis are that higher population density and a contract being operated by a publicly owned (municipal or county council) operator are both associated with having higher costs. Also, no statistically significant differences could be found when using incentive payments in the contracts.

**Papper II** - “Cost Efficiency in Swedish Public Transport” - has a similar perspective as Paper I, but it uses stochastic frontier analysis to focus on cost efficiency and differences across PTAs. Data for the year 2013 are used, along with other data sources, to derive a cost frontier from which some of the deviations from this can be attributed to cost inefficiencies. The results are similar to those of Paper I, namely that cost efficiency is lower in high-density areas and in contracts that are directly awarded to a publicly owned operator. When comparing the cost efficiency of the PTAs (or counties), most exhibit small differences. The difference between the 1st and 15th-ranked county is only about 8 percent. The difference is somewhat larger when turning to the third and second least efficient counties of Stockholm and Skåne. The least efficient county of Västmanland is about 30 less cost efficient than the 1st-ranked county.
Sammanfattning


I den tillhörande kappan beskrivs de senaste decenniernas utveckling i den svenska kollektivtrafiken, med ett större fokus på de senaste tio åren med branschens fördublingsprojekt samt marknadsöppningen år 2012. Som nämntes tidigare har kostnaderna som helhet, samt olika typer av styckkostnader såsom kostnad per körd utbudskilometer, ökat i reella termer sedan 2007. Även om delar av kostnadsökningarna kan attribueras till ett ökat utbud eller prisökningar i insatsfaktorer kan utvecklingen ändå vara problematisk av åtminstone två anledningar. För det första verkar branschens ambition att fördubbla resandet till år 2020 ha gett en utbudsökning under åren kring 2010, och en resandeökning något år senare. Vad som är tydligt är dock att både kostnaden per utbudskilometer och passagerare ökat. I ljuset av detta blir det tveksamt om utbudsökningarna skett på rätt ställen. För det andra är det oklart om en prisökning i insatsfaktorerna kan ses som "acceptabla" anledningar till branschens kostnadsökning. I den mån kollektivtrafikmyndigheter och/eller operatörer kan påverka priset på insatsfaktorer såsom bussar (särkrav, miljökrav etc.) eller personal (personalövertagande etc.) riskerar man ett endogent samband vilket gör att dessa, potentiellt kostnadsdrivande, faktorer lätt kan sorterades bort som allmänna prisökningar. I slutet av kappan förs även en diskussion om den bristande tillgången på offentlig data i svensk kollektivtrafik, och att kollektivtrafikmyndigheterna inte följer uppsatta EU förordningar relaterat till detta. Ett större utbud av data, och helst...
ett öppet sådant, skulle möjliggöra för mer jämförelser mellan kontrakt, utförare och kollektivtrafikmyndigheter, vilket i förlängningen tydligare skulle kunna påvisa bra och dåliga exempel i branschen och bidra ett bättre resursutnyttjande av skatteandel.

Nedan följer en sammanfattning av de två papper som ingår i licentiatuppsatsen.


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Paper I. Costs for Swedish Public Transport Authorities

Paper II. Cost Efficiency in Swedish Public Transport
Cover Essay
1 Introduction

Keeping track of costs and being cost efficient are two essential issues when providing services using public funds, and is what this thesis is mainly occupied with. In this cover thesis, these subjects will be discussed, and some implications given in light of the national statistics and results from the two papers included. First, however, a discussion about why public transport is needed today’s society, and the organization of Swedish public transport, is given to provide a motivation and background for the discussion made in the remainder of the text, and the two papers included in the thesis.

Public transport is an important part of today’s transport system. In Sweden, the country in focus of this thesis, the idea that society needs this service is not contested because it provides a basic supply of transportation for citizens and increased mobility for all groups in society. The Swedish public transport provision is to a large extent funded by public subsidies using public funds received in competition with other public sectors. Since 2007, the share of costs covered by traffic revenues (the subsidy ratio) has been stable at around 50 percent on the national level (49 percent in 2014), although there are differences between regions (Transport Analysis, 2015b). In 2014, the total amount of public subsidies to cover operating expenses in the public transport sector was over 21,000 million SEK (about 2,250 million euros) (Transport Analysis, 2015b). Among others, Nilsson (2011) and Rye and Ison (2012) list five reasons why subsidies and involvement by the public is necessary (the list is not in order of importance).

- Providing public transport services are though to exhibit scale economies, implying that subsidies would increase supply and thus the overall welfare of society.
- There will be a decrease in negative externalities from private transportation modes, for example, congestion and pollution.
- Because public transport exhibits increasing economies of scale in frequency and urban users’ waiting time, a higher supply of public transport services is motivated from a welfare perspective than would be provided by the private market alone. This is also known as the Mohring effect (Mohring, 1972; Jansson, 1980).
Users of private transportation value an alternative to their preferred choice of transportation, also known as option-value.

There is equity through accessibility for vulnerable groups in society and those living in different geographical areas.

Arguments against subsidies also exist. First, the lack of competition facing an all-subsidized enterprise removes the profit-maximizing incentives and would thus raise costs as a consequence of, for example, strong unions bargaining for their members (Parry and Small, 2009; Rye and Ison, 2012). However, one could argue that this issue is minor in Swedish public transport due to the high degree of competitive tendering. Second, the marginal cost of public funds is an important and non-trivial aspect of subsidization. Parry and Small (2009) show in an analytical example that even when accounting for this, high subsidies are still called for.

Despite the reasons in favor of public transport, caution must be taken when carrying out and funding the service for at least two reasons. First, the fact that public funds are used calls for adequate methods and reasoning for what and where the funds should be used in the public transport system. For example, would it increase social welfare more to decrease the fare for travelers or to build a new tramline? Cost-benefit analysis can be an important tool here, and economic efficiency is clearly stated as one of the overall goals of Swedish transport politics. Second, funds allocated to the public transport system are not available for other parts in the public sector such as health care, education, or elderly care. This implies that unaccounted or unexplained increases in cost need to be covered with more public funding, enhancing the competition for funds. Also, because public transport is provided by each county themselves, funding is mainly an issue at the regional level and does not affect the national government directly.

In a report to the Expert Group on Public Economics, a committee of the Swedish Ministry of Finance, the organization of the Swedish public transport system and the current state of the system were described. The title summarizes well the conclusions from the report: “Public transport without control” (“Kollektivtrafik utan styrning”). The report notes that key decisions about public transport provision are made by the boards of the Public Transport Authorities (PTAs and the politicians responsible for appointing members to these boards. This means that the practitioners’, for example, the bus operators’, knowledge about the service provision is easily
forgone, and this increases the risk of making a bad decision (Nilsson, 2011). Of course, tighter cooperation between officials, or civil servants, at the PTA and the operator can reduce this risk, but only if the experiences are transferred to the board and the politicians. Also, the PTAs’ lack of follow-up on contracts, and the design of new contracts without much analysis from previous contract setups, which in turn raises doubts about the democratic responsibility (Nilsson, 2011). Information about costs, supply, and other indicators is difficult to obtain, and this also hinders transparency in the public sector.

The report also notes that operating cost for providing public transport services in Sweden has increased over a long time, an observation also made by Holmgren (2014) and Transport Analysis (2015a). The Swedish Bus and Coach federation (2015) confirms this, but it also notes that there are differences in cost development across PTAs. Using national statistics from Transport Analysis, CPI (Consumer Price Index)-adjusted operating costs – which are often used when describing the cost development in Swedish public transport – for bus traffic increased by 32 percent between 2007 and 2014. A report by SKL (2012) suggests that most of the cost increase between 2007 and 2012 can be attributed to increases in input factor prices, but the implications from this finding are not straightforward if input prices can be affected by operators or PTAs directly, which will be discussed further in Section 3.

No matter the reasons behind it, a large increase in spending calls for caution and care when developing the public transport system, as discussed earlier. This, in combination with conclusions made by Nilsson (2011), calls for an investigation into how costs are affected by different factors and how these factors could be used in order to improve the cost development in the sector. There is little empirical work in this regard in Sweden, and this constitutes the main motivation for the two papers in this thesis.

The following section provides a discussion on the organization of Swedish public transport, and this is followed by Section 3 with a more detailed investigation of the cost development over the last seven years. A discussion on data availability is given in Section 4. In Section 5, the papers and their results are discussed. Finally, Section 6 gives some concluding remarks. Throughout the remainder of the paper, the term “public transport” will refer to public transport provision by bus if not stated otherwise.
2 Swedish Public Transport

This section discusses some of the more important highlights of the organizational development of regional bus public transport in Sweden since the late 1970s.

Throughout most of the 20th century, public transport was carried out by private operators holding exclusive licenses, or concessions, for their bus lines. The large number of operators, in combination with little coordination of fares, tickets, and timetables, gives the impression of a fragmented market (Nilsson, 2011). In 1978, the Transport Policy Act required that PTAs be established in each county by the County councils and/or local municipalities with the responsibility to coordinate the public transport services in its respective county. The PTAs also became responsible for the traffic supply and could decide whether the services would be provided by the previous operators or by the PTA itself.

The next big organizational reform was made in 1989 when the PTAs were given the exclusive right to provide public transport services in their counties. This meant that the operators’ exclusive licenses were canceled, an action that was not appreciated among the operators (Alexandersson and Alexandersson, 1995). The reform was motivated by the previous years’ increased costs, which stemmed from an increased subsidy ratio that rose from 20 percent in the 1970s to about 50 percent in the mid-1980s (Alexandersson and Alexandersson, 1995). After the reform, the PTA could choose to provide service by giving concessions to specific operators, providing the service themselves, or putting out the service for competitive tendering. Over the next few years, competitive tendering would become the most popular method of providing service with 20 percent of the total traffic tendered in 1989 and over 50 percent in 1993 (Alexandersson and Pyddoke, 2010). In the late 1990s, over 90 percent of the bus traffic was subject to competitive tendering (Alexandersson and Pyddoke, 2010).

The effects of the 1989 reform became apparent relatively quickly. Alexandersson et al. (1998) estimate the cost reduction of competitive tendering to be 8.4 percent between 1987 and 1993, a number that was lowered to 6.2 percent in the follow-up study by Alexandersson and

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3 The public transport organized within a county is either local (city traffic) or regional (other traffic). However, the difference is often vague and the term “regional” is used here for both types of public transport (Transport Analysis, 2015b).

4 For a more comprehensive discussion on this matter, the reader is recommended to turn to Jansson and Wallin (1991), Alexandersson (2010), Nilsson (2011), SOU 2009:39, or Transport Analysis (2014).

5 A more detailed summary of the county-wise adoption of competitive tendering of bus services is found in Alexandersson (2010).
Pyddoke (2010). Hensher and Wallis (2005) note that this type of cost reduction is not uncommon when introducing competitive tendering, but they also note that the effect is often offset when additional tendering rounds are made. This effect was also found in Alexandersson and Pyddoke (2010).

In the years following the 1989 reform, the public transport industry raised concerns about stagnation in the development of public transport (Swedish Doubling Project, 2009). As a consequence, the industry launched the “Doubling Project” in 2008 where more or less all actors in the public transport sector, both private and public, became involved in the organization “Partner Cooperation for Doubled Public Transport”\(^6\). The project’s goal is to double the travel with public transport by the year 2020 compared to year 2006, it aims to double the market share of public transport by the year 2030. The overall purpose is to improve public transport for the users (Swedish Doubling Project, 2009). Over the last few years, the project has tried to standardize contracts and bus specifications to make them more uniform across PTAs and to involve the operators more through incentive mechanisms. Further, increased cooperation between PTAs and operators is thought to increase transparency and give better service, which in turn would benefit the passengers.

In 2012, the Government passed a new public transport law with the motivation that the passengers’ perspective must be put more in focus by having more market dynamics, better coordination between the regional (or general) public transport and the special transport services, and harmonization of Swedish law with EU law (SOU 2009:39; Transport Analysis, 2014). With the new law, the organizational form of the PTAs became more formalized. Instead of PTAs being a joint company or institution, they are now regional agencies (or county coordinating bodies). Another change is that the PTAs must now regularly establish “traffic supply programs” in which the current and future commitments for public transport services are described, as well as goals for the same. Further, the new law introduced the possibility for private operators to establish their own public transport services alongside the PTAs\(^7\), implying a market opening. The potential for commercially provided public transport must also be considered in the traffic supply programs and should ideally be operated by commercial actors if possible.

Although expectations were high that private actors would establish commercial public

\(^6\)In 2012, the organization changed its name to “Partner cooperation for improved public transport” with its goals and projects unchanged.

\(^7\)Since 1999, this had only been allowed for inter-regional bus services (long-distance buses).
transport alongside the subsidized services after the market opening, this has not been the case. Transport Analysis evaluated the results of the 2012 reform and concluded that the new law has had a “very marginal importance for supply and travel choices for the passengers” (Transport Analysis, 2014, p. 9). Further, the entry of commercial actors providing commercial regional public transport has been modest with only 2.9 percent of the total supply in 2014, the majority being passenger services to airports, traffic that in many cases existed before the passing of the new law. Lastly, many PTAs have failed to establish goals or to describe their traffic commitment, and they often neglect the need and possibilities for commercial traffic. The explanations for this are substantial entry barriers and difficulties competing with subsidized public transport. The report’s main conclusion is that the reform is regarded as “unfinished” (Transport Analysis, 2014, p. 9).

Figure 1 illustrates the development of four cost, supply, and demand-related measures between 2007 and 2014: operation costs (deflated with CPI), vehicle kilometer, seat kilometer, and number

Figure 1: Development of cost, supply, and demand indicators between 2007 and 2014. Source: Transport Analysis (2015b)
of boardings. The figure is on bus transport\textsuperscript{8} on the national level, excluding the county of Stockholm\textsuperscript{9}. During the seven years, CPI-adjusted costs have increased by over 30 percent. The development seems to have been steady, almost linear, with no apparent sign of slowing down. The same reasoning holds for the number of supplied seat kilometers\textsuperscript{10}. For the first four years, a similar increase is seen in the number of vehicle kilometers supplied, but this trend is broken in 2012 after which remains it constant. A possible explanation both for the cost increase and the sharply increased supply could be the public transport industry establishing the Doubling Project in 2008. The curve showing the number of boardings on the national level has only increased by 19 percent since 2007, and this adds to the impression that the industry is still far from reaching its goal. Rather, the costs for public transport are more likely to be doubled in 2020. In 2014, the market share of public transport was still only 27 percent (19 percent 2006) (SIKA, 2007; SPTA, 2015). Lastly, the increase in the last three measures would suggest that, on average, larger buses are used.

In the next section, the development of costs for public transport services made by bus is analyzed in more detail.

3 Cost Development

Having discussed the main motivations for public transport and the organizational development for the sector during the last decades, this section analyzes the last years development in total costs. The section starts with analyzing the development and decomposes this into increased factor prices and supply. Thereafter, the section illustrates and discusses the trends in four cost measures.

As in the previous section, the figures in this section only take into account transportation by bus, and they exclude Stockholm. As was also noted, CPI-adjusted costs have increased by 32 percent over the past seven years. Is it possible to say something about what has caused this? An attempt to do this is made in Figure 2. The figure shows four lines that will be discussed in turn from top to bottom. The solid line shows the increase in costs between 2007 and 2014 in nominal terms (no deflation) and acts as a baseline. Deflating using the Swedish CPI index,\textsuperscript{8}Bus transport is chosen in order to account for changes in input factor prices discussed in the next section. \textsuperscript{9}Excluding Stockholm is not thought to alter the implications from this discussion. The county is excluded because statistics from Transport Analysis report the bus statistics without Stockholm. \textsuperscript{10}Information about seat kilometers is only available since 2008.
Figure 2: Cost development between 2007 and 2014 adjusted for price and supply effects. Source: Transport Analysis (2015b), Statistics Sweden and the SPTA

and thereby adjusting for the average price increase, explains ten percentage points of the cost increase and gives the same cost increase as illustrated in Figure 1. However, deflating using CPI might not be enough. Beck and Walter (2013) note that it is necessary to use (or construct) an industry index in order to account for changes in industry-specific input factor prices. For Swedish public transport, this has been done in SKL (2012) where 45 percent of the total cost per kilometer was explained by an industry index. Here, the industry index constructed by the Swedish Public Transport Association (Svensk Kollektivtrafik, SPTA) is used, and the following five price indices are combined and weighted: labor cost (AKI, 55%), fuel price (price of diesel oil, 15%), acquisition of new vehicles (ITPI, 10%), financing (STIBOR 3M, 5%), and the average price level (CPI, 15%) (SPTA, 2014). Using this index instead of the CPI adds an additional four percentage points to the explained increase. Thus, deflating using the industry index adds little information compared to the CPI. Finally, taking into account the increased supply by dividing operating costs by the number of vehicle kilometers (yielding the cost per vehicle kilometer) explains an additional 17 percentage points. The remaining increase in cost is now 11 percent for
the last seven years.

Explaining cost development using an industry index is, however, not uncomplicated. The reason is that price increases in the main factor prices could potentially hide information because the relationship is endogenous in the input factors that operators and PTAs can affect directly. For example, detailed specifications for buses could have cost-driving effects and increase total costs, but these will be “hidden” as an input factor increase if the increased price of buses is accounted for in an indexing model. If one suspects that, for example, detailed specification of buses or stricter environmental standards are the reasons for the last years increases in total costs, the appropriate deflating method needs to be considered.

Summarizing Figure 2, the main implication is, as was noted in SKL (2012), that the increase in supply and input factor prices explains a vast share of the increase in costs during the last seven years. One could stop here and claim that because a majority of the cost increase is explained, this issue needs no more attention. This claim can be contested for at least three arguments. First, there is still an 11 percent increase that is unexplained (or 25 percent of the non-deflated cost curve). Second, because a large share of the costs can be explained does not mean the increase is acceptable. This calls for more knowledge about cost efficiency and how to get the most out of the money spent, as called for by Nilsson (2011). Finally, cost per vehicle kilometer seems to have an upward trend since 2011, which is not desirable. The same holds for how much of the cost increase can be explained because this portion shrinks over the years.

Figure 3 gives a hint of the current state of the public transport provision, and it shows trends for the same. It was shown previously that the number of seat kilometers has increased substantially over the last seven years. This has an impact on the cost per seat kilometer, which shows a steady decline since 2008. In 2012, the trend starts to change and the numbers rise between 2013 and 2014. Turning to the cost per vehicle kilometer, boarding, and passenger kilometer, the development is quite different, but similar for the three. Starting with a decrease between 2007 and 2008, mainly due to factors relating to the development of the industry price index during the financial crisis of 2008, the measures show increases after 2008. Since 2011, there is an upward trend towards more expensive transport provision. Most notable is the trend in cost per passenger kilometer; in 2014 it was 20 percent more expensive to drive a passenger one kilometer compared to 2007.
The overall impression is that the per unit cost measures of Swedish public transport are going in the wrong direction with respect to cost efficiency and getting the most out of public funds, which in turn calls for more innovative solutions and knowledge about public transport services. This requires detailed data of sufficient quality, and this is discussed in the next section.

4 Data availability

A key issue when analyzing the performance of any sector is the availability of data. For the Swedish public transport sector, publicly available data is very limited (Nilsson, 2011; Transport Analysis, 2015a). The main source for cost, supply, and demand data for public transport is the annual reports from Transport Analysis. These reports contain county-level data that are reported to Transport Analysis by each PTA. The data are comparable since 2007, which gives a relatively good time span for analysis. However, the aggregation level makes it hard to control for heterogeneity such as population density. In addition, some counties add arbitrary values to some
figures to correct, for example, for passengers not accounted for in the regular passenger counts. The last issue is clearly illustrated in a report by The Swedish Bus and Coach federation (2015) where one of the key findings is that the cost per passenger in the county of Dalarna increased by 50 percent between 2007 and 2013, and by 43 percent between 2012 and 2013. Although a 50 percent increase over six years could the 43 percent increase in one year is unlikely. The explanation for these figures is that Dalarna since 2013 no longer seems to add 3,400 passengers (an arbitrary add-up), which in turn gives the impression that the number of boardings has decreased substantially in the county in one year. Similar “adding-issues” and mis-reports by the counties have been present during the years, which can call into question the quality of the annual statistics. This is, of course, the responsibility of the user of the data, but more importantly it is the responsibility of the organizations that are reporting and making the data available (e.g., the PTAs).

According to Regulation (EC) No 1370/2007 of the European Parliament and of the Council of 23 October 2007 on public passenger transport services by rail and by road, “Each competent authority shall make public once a year an aggregated report on the public service obligations for which it is responsible, the selected public service operators and the compensation payments and exclusive rights granted to the said public service operators by way of reimbursement.”. Although the regulation has been in place since 2007, only the county of Södermanland has published reports, and only since 2013 (Transport Analysis, 2015a). This means that 20 PTAs in Sweden do not comply with existing laws, which means less transparent operations and limited possibilities for analysis. With the lack of data provided by the PTAs, Transport Analysis has recently started to collect data similar to the data required by European Regulation 1370/200711. Although the data cover the years 2010 to 2013, the poor data quality and non-responses in the two first years only allows for analysis of the years 2012 and 2013. It is to this author’s knowledge the first time that such complete and more disaggregate data on public transport has been made publicly available, and this provides the opportunity for new types of analyses. However, the short time span does not yet allow for time-series analyses. These are the data used in the two papers in this thesis, and the data are described in more detail in both papers.

Having described the two main sources of data currently available for the Swedish public

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11 It should be clarified that the data collection made here by Transport Analysis does not take away the responsibility of the PTAs.
transport system, one conclusion is that information in the field is scarce. So, how can this situation take a turn for the better? Two answers are that Transport Analysis should continue with its data collection on the contract level, but perhaps more importantly that the PTAs should actually produce the statistics required of them by law. The latter would not only shed light on how the public transport system in the county is doing, but also would allow for comparison across counties and the ability to learn from those who are improving their transport system so as to avoid making the same mistakes that others have already made. The last point is perhaps the most important. We as researchers could also help in this transition to better data. Undertaking policy-relevant analyses can both highlight the need for data and show the PTAs what can actually be done with such information. Focusing on one or a few PTAs and investigating their potential databases and then performing geographically restricted analyses could be one way of doing this. The key issue here is, however, to establish contact with the right PTAs and persons in the organizations to make this happen. In Nilsson (2011) it is noted that many PTAs do not have very good insight into what data are available, if any. This has also been experienced by this author. However, this situation might have changed since 2011 with the rapid development in technology.

5 The Papers

Two papers are included in this thesis and are motivated in light of the previous discussion. In recent years, the design and content of tendered contracts have been in focus within the transport industry, and this has resulted in the standardized contracts developed as part of the Doubling Project. While the adoption of the new contracts has been relatively good (The Swedish Bus and Coach Federation, 2014), there is little knowledge on how costs are actually affected by different components and how the PTAs differ in terms of efficiency. For example, the industry now often uses incentive mechanisms tied to passengers and rewards the operators monetarily. The contracting scheme is similar to the net-contract, but generally has a higher share of subsidies. The increased use of incentives has been one of the key points in the Doubling Project, and introducing more incentives was believed to get the operators to become more involved in improving the transport service rather than having them only minimizing costs (Swedish Doubling Project, 2009). Paper I presents a theoretical model for the cost mechanisms in Swedish public transport,
including the incentive mechanisms that, all else being equal, should impose risk for the operator and thus higher costs for the PTA.

The two papers are related to each other but have different focuses. The objective of Paper I, “Costs for Swedish Public Transport Authorities”, is to use econometric methods to identify how different factors relating to contract design or the operating area affect costs for the PTA. Such factors include supply, contracting length, and operator type (large or publicly owned operator). The paper also distinguishes between gross-cost and incentives contracts, as well as fixed and incentive payments, in order to find potential differences. The paper uses the contract-level data collected by Transport Analysis described above. The data are a cross-section for the year 2012 and include 269 tendered and directly awarded bus contracts for 20 PTAs.

Paper II, “Cost Efficiency in Swedish Public Transport”, has a similar starting point as the previous paper, but it focuses on cost efficiency and how this differs between the 21 PTAs. The purpose of Paper II is to determine how contracting factors affect the cost efficiency of the PTAs and whether the PTAs differ in terms of cost efficiency. After defining a cost function and its input factor prices, similar contract factors are included and the cost function is analyzed using a stochastic frontier analysis method similar to Coelli et al. (1999). This produces observation-specific cost-efficiency scores, which in turn can be aggregated for each PTA and can provide scores that can be compared to each other. Similarly to Paper I, the analysis uses the contract data from Transport Analysis, but for year 2013, which gives 281 contract observations for all 21 counties.

Overall results

The main results from Papers I and II are presented in this section, and they will be discussed jointly because the papers are related in terms of research question and methodology and because the results are similar and interconnected. Both papers use total costs (payments) as the dependent variable, although Paper I also analyzes fixed and incentive costs separately.

Both papers have high coefficient estimates for the supply-related variable – the number of driven vehicle kilometers – although Paper I presents a slightly lower estimate (0.89 versus 1.00) implying constant or small economies of scale. Possible explanations for this difference are that the samples and years differ as well as the estimation method. The difference is, however, not
large, and does not change the conclusion drawn from the results that a one percent increase in supply results in a close to one percent increase in costs.

The papers investigate the impact of operator type, population density, and contract length on costs. The results suggest that costs are not affected if a large operator is operating the contract, nor are they affected by how many years the PTA chooses to contract an area for. Contrary to this, costs are found to increase both with population density and if a publicly owned operator provides the service. The first result confirms that results on an international level apply to Sweden as well. The second result gives good reasons for PTAs and municipalities to leave public transport operations to market actors. There is also a difference in the definition of the “Publicly owned operator” dummy variable in the two papers. In Paper I the variable takes the value 1 if the contract is operated by a publicly owned operator (irrespective of awarding method), while Paper II only considers contracts that are directly awarded (in all cases to a publicly owned operator). The results imply higher costs in both cases, and this provides a reason not to award contracts to public operators directly.

As was noted in the previous section, the papers also investigate the impact of incentive payments on costs. The theory outlined in Paper I suggests that costs should be higher with incentives because of the risk imposed on the operator, but no results indicate that this is the case. Compared to a gross-cost contract, no differences in costs are found when including incentive payments irrespective of the share of incentives used. However, incentive payments are found to lower the share of fixed payments with the share of incentives, which was expected from the theory.

Turning to cost efficiencies estimated in Paper II, both increased population density and publicly owned operations are associated with reduced cost efficiency. The efficiency scores suggest that most PTAs do not differ very much in cost efficiency because there is only a 5 percent difference between the 1st and 15th-ranked PTA. However, some differences could be seen for the counties of Stockholm and Skåne, which have about 12 percent lower cost-efficiency estimates than the 1st-ranked county, and for Västmanland, which has almost 30 percent lower cost-efficiency estimates. It should be noted that Västmanland is the only county directly awarding its own operator more or less all of its public transport provision.
6 Conclusion remarks

This thesis presents empirical studies on how different contract factors affect costs and cost efficiency in Swedish public transport. This is a somewhat overlooked area in Swedish public transport, which is often more occupied with measures for improving the passenger experience rather than cost efficiency. The lack of follow-up and monitoring among the Swedish PTAs is also noted by Nilsson (2011).

The cost increase over the last seven years can to a large extent be attributed to higher input factor prices and an increased supply. The result that public transport provision is more expensive the more densely populated an area is, when controlling for other factors such as vehicle kilometers driven, calls for greater caution when organizing public transport in such areas, but also indicates where the biggest financial savings could be made. In, for example, the county of Västernorrland, the city of Sundsvall alone accounts for over 30 percent of the total costs for the county’s bus system.

An important finding in the two papers is that providing public transport services direct awarding to a publicly owned operator are associated with higher costs. The policy implication is that introducing competitive tendering could have a cost-dampening impact on public expenditures. If direct awarding is still to be used, this should be clearly analyzed and motivated. For example, the city of Luleå provides its own bus services and receives high customer satisfaction ratings (SPTA, 2015). In an interview, the operator’s CEO claimed that the design of a more efficient line network, along with investment in environmentally friendly vehicles (which is an overall trend in Sweden), were the main explanations (Affärstidningen Näringsliv, 2013). These explanations are most likely valid, but the high ratings might also be achieved equally well using competitive tendering and cooperation between the new operator and the PTA. This type of cooperation is also a key point in the Doubling Project. The correlation between the public operator and high customer satisfaction in Luleå is often acknowledged, but the causality is more debatable. The fact that all publicly owned operators are run as joint-stock companies (aktiebolag) further questions this causality.

What has not been discussed to a great extent in this thesis is the importance of analyzing

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12 This has been the main focus for the Doubling Project, as well as the new Public Transport Law, SOU 2009:39.
social welfare through, for example, cost-benefit analysis. As was mentioned in the introduction, subsidies to public transport are motivated by several reasons in order to increase social welfare. Therefore, costs should not automatically be regarded as something negative because expenditures are needed in order to account for market failures. The important insight is that money should be spent where the social welfare can be improved the most. All PTAs have formulations about social welfare in their respective traffic supply programs. However, when studying the latest versions of the programs, only three PTAs clearly state, or give hints, that calculations of social welfare (mainly by cost-benefit analysis) are actually carried out when changing fares, supply, or other aspects of the public transport system\textsuperscript{13}\textsuperscript{14}. In 2003, Ljungberg (2007) carried out a survey of the PTAs and also concluded that most PTAs do not use cost-benefit analysis as a planning tool. For the city of Linköping, Ljungberg (2010) shows that net increases in social benefits are very well possible by straightening bus routes, optimizing bus sizes, and adjusting starting times for schools. Lidestam and Abrahamsson (2010) give similar implications when analyzing bus sizes and CO\textsubscript{2} emissions.

How will Swedish public transport develop in the coming years? The trends shown in Figures 1 and 3 do not give an optimistic view in terms of increases in cost per vehicle kilometer and boarding, and the stagnant number of boardings makes the doubling goal look unrealistic. One hope is that the collection of contract data by Transport Analysis will allow for more research and analysis on the public transport industry, which in turn could make the PTAs aware of the benefits of using and publishing data and providing more policy-relevant recommendations. One example of the “spill-over effects” of publishing data is the project Trafiklab, launched by Samtrafiken, that collects all publically available data in the public transport industry. Using Trafiklab, numerous apps and webpages have been created by people outside the industry, which in turn have improved the ease and effectiveness for the ordinary passenger. In addition, making economic and travel data available, like Transport for London has done, could give similar spillovers from research investigating, for example, incentive mechanisms, contractual forms, passenger behavior, and risk in public transport. This also gives more transparency in how each PTA is doing and could give good, and bad, examples of how to manage public transport. Of course, researchers also have a responsibility here in cooperating with the actors in the industry, sharing results, and conducting

\textsuperscript{13}Whether or not this is true, and to what extent it is made, calls for a more thorough investigation.

\textsuperscript{14}It should be added that the PTAs could in fact use cost-benefit studies even though they are not stated in the traffic supply program.
policy-relevant research.
7 Bibliography


