Competition in Public Transport

Essays on competitive tendering and open-access competition in Sweden

ANDREAS VIGREN

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KTH Royal Institute of Technology
School of Architecture and the Built Environment
Department of Transport Science
SE-100 44 Stockholm
SWEDEN

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Supervisors:
Assoc. Prof. Svante Mandell, KTH
Prof. Jan-Eric Nilsson, VTI

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Till Docksta:

"Det finns inga bojor eller band
som kan hindra mina tankar att färdas norrut
på våren, som en flygande and.

Det är här man känner vart stigarna går,
och man vet vem som är släkt med vem.
Det är här man vet var gäddorna står,
ja det är hit man kommer när man kommer hem"


Text av Ronny Eriksson.
Abstract

The competitive environment in Swedish public transport has undergone major changes in recent decades, going from a situation with private sector monopolies to one where competitive tendering and open access competition is the rule. However, irrespective of the regime, proper analyses and evaluations are required to determine how the market is functioning and what measures should be taken to improve it. This thesis analyzes how contracts for tendered bus services can be better designed for higher cost efficiency and greater competition, and it assesses the effects on ticket prices following the first substantial entry in the Swedish open access railway market.

For such analysis and evaluation, data availability and data quality are essential. However, the data situation in the Swedish public transport sector is poor, especially the publicly available data, as is the case for most of Europe. For this reason, new, and in many respects unique, data were gathered for use in this thesis on tendered contracts in bus services and the prices of operators on the commercial railway market. These data made it possible to analyze tendered bus contracts and open access competition in Sweden in more detail than has been done previously. The high level of detail in these reports provides new and useful information and allows for better advice to be given to policy makers.

The results of this work show that the cost efficiency of tendered bus services is similar across all Swedish counties, except for the more high-density counties where efficiency is lower. Considerably lower efficiency is also found for contracts with services run in-house by the Public Transport Authority (PTA), compared to when the same service is run by a private actor. With respect to the competitive environment, it was found that many contract design factors have little or no effect on the number of bids that the PTA sees in their tenders. No measure that could be imposed by a single PTA was found to increase the total number of bidders by more than 0.5 bidders. However, the results suggest that PTAs as a collective could try to avoid tendering too
many contracts at the same time because this was shown to reduce participation by up to about
two bidders. In addition, these studies show that the local competitive environment is important
for the PTAs to consider. The way in which contract areas are defined will also affect the
participation rate as operators were found to participate in tenders to a lower extent the farther
their workplaces are from the contract area. While larger operators appear to be less sensitive
with respect to such distances, the fact that smaller operators are, and that they often bid as one
unit as members of cooperation companies, makes the competitive environment important. The
results suggest that depots could be included in the contract to stimulate participation, but this
is by no means the only nor an easy solution.

As a further investigation into competition in Swedish public transport markets, this thesis
has analyzed the entry made in 2015 by MTR Express (MTR) on the Stockholm-Gothenburg
railway line. The overall conclusion is that customers are indeed facing lower prices one and a
half years after the entry. MTR’s prices are on average 100 SEK lower than the incumbent SJ’s
prices. Furthermore, the analysis shows that the incumbent’s prices have also gone down, by
almost 13 percent, following the entry. It is important to note that these are only the results of
the short-run effects of the entry, and the more long-term development is yet to be determined.
Sammanfattning

Marknadsmiljön i svensk kollektivtrafik har förändrats över de senaste decennierna. Den har gått från en situation med privata monopol till en där konkurrensutsatt upphandling och open access konkurrens råder. Oavsett vilken reglering som gäller krävs dock bra analyser och utvärderingar på hur transportmarknaden fungerar, samt med vilka medel som bör användas för att förbättra densamma. Denna avhandling analyserar hur kontrakt för upphandlad kollektivtrafik kan förbättras för att uppnå högre kostnadseffektivitet och bättre konkurrens, och vilka effekter på biljettpriser det första stora inträdet på den numera konkurrensutsatta svenska järnvägsmarknaden haft.

För analys och utvärdering är tillgången och kvalitén på data grundläggande. Denna situation är dock bristfällig i både svensk och europeisk kollektivtrafik. Därför har ny, och i många avseenden unik, data samlats in för användning på upphandlande busskontrakt och biljettpriser hos tågoperatörer. Den insamlade datan har gjort det möjligt att analysera dessa områden i mer detalj än vad som gjorts tidigare. Även om det finns tidigare studier i dessa ämnen är litteraturen på transportområdet inte så rik som den skulle kunna vara med bättre och mer tillgänglig data. De fyra artiklarna som ingår i avhandlingen ger därför bidrag till forskningen genom att i mer detalj undersöka kontraktsutformning och konkurrens i buss- och järnvägsmarknaden, vilket också ger bättre rekommendationer till beslutsfattare.

Resultaten visar att kostnadseffektiviteten i upphandlade busskontrakt inte skiljer sig nämnvärt mellan svenska län och regioner, utom i mer tätbefolkade områden där effektiviteten är lägre. Betydligt lägre kostnadseffektivitet har påvisats också i områden där de regionala kollektivtrafikmyndigheterna (RKM) kör trafiken i egen regi. Vad gäller konkurrens har det visats att många kontraktsrelaterade faktorer har begränsad eller ingen effekt på antalet bud RKM får i sina upphandlingar. Inga kontraktsfaktorer kunde ensamt påverka antalet budgivare med mer än runt

First, and foremost, I want to thank my supervisor Svante Mandell for his constant support and help with my work on this thesis. You have given me the opportunity to form the thesis with my own ideas and approaches, while still pointing me in the right directions. I am also grateful for you giving me such responsibility for my work. I could not have wished for a better supervisor. Again, thank you.

I want also to thank my co-supervisor Jan-Eric Nilsson. Your knowledge of the railway and public transport sector has been of great help in my writing, as well as your wise comments from reading my work.

During my four years at VTI and TEK, I have come to realize that the working environment is essential for doing good work. The newspaper *Dagens Nyheter* once had an online poll asking, “How often do you laugh in your workplace?”, with the options 0, 1, 2, 3, and 4 times a day. This poll caused a laugh at the fika because four laughs are nowhere near what we do in one day. There is a mutual understanding and respect for one another here that I value highly. Everyone makes a contribution to this, and everyone has therefore contributed to the joy that I have had in coming to work every day. There are, however, some people I want to acknowledge specifically. Hanna and Magnus, my partners in crime (and beers). Roger, for all the talks and initiated discussions about my papers. Also, Anna, Gunilla, Inge, Johan, Mattias, and Samuel. Regarding people outside VTI, I first want to thank Jonas and Maria (well, Maria is actually with us at VTI now). Without you, I would not have ended up here. Thanks for seeing potential in a guy who could not draw a proper illustration of a Pigovian tax. Also thank you to Johan Holmgren for being the opponent at my licentiate seminar, to Sofia Lundberg for your important comments and remarks on this thesis, Anders Karlström, and Maria Melkersson. To Ulrika, Per, Nadia, and
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Andreas
Stockhom, November 2017
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Paper I. Cost Efficiency in Swedish Public Transport

Paper II. How Many Want to Drive the Bus?

Paper III. The Distance Factor in Bus Contracts

Paper IV. Competition in Swedish Passenger Railway
“‘Begin at the beginning,’ the King said, very gravely,
‘and go on till you come to the end: then stop.’”

The King of Hearts in Alice’s Adventures in Wonderland.
Written by Lewis Carroll.
1 Introduction

The organization of transport markets is a constantly developing matter, not only in how the markets and companies function, but also the extent to which regulation is needed, how and where the public should intervene, and the extent of any interventions. Although political bias is a factor in this that cannot be neglected when reforms are carried out (Vickerman, 2015), it is arguable that the primary goal of any such regulations and interventions is to achieve the best possible welfare outcome. Whether this is social welfare, corporate welfare, or the welfare of certain individual groups can, of course, vary, but still the changes are intended to improve some situation. In this thesis, the term welfare will refer mainly to social welfare.

Traditionally, many transport markets have been considered to require relatively strong regulations by the ruling politicians, with little freedom for the operators, in order to deliver high welfare. These regulations have lately come to be relaxed, and the Swedish regional bus transport market might serve as an example of such a liberalization regime. While private firms had exclusive licenses to run specific routes and had little direct competition in the early 20th century, the industry became more heavily regulated in the 1960s as profits decreased following the rise in private car ownership (Alexandersson, 2010). Further on, the trend became one of more expropriation of operators, more subsidies, and greater coordination of fares and schedules in the 1970s, which was the time when the Public Transport Authorities (PTAs) were established (Alexandersson, 2010). A decade later, competitive tendering was introduced, which was a contract-awarding method that came to dominate the public transport bus provision. This situation implies more private supply than in the 70s and early 80s, and it is currently the standard way of procuring public transport services in Sweden. Today, over 90 percent of the total supply is tendered out. Legislatively, regulations were further relaxed by the Public Transport Act of 2012 (SFS 2010:1065), which allowed for open competition alongside subsidized traffic within the PTAs’ jurisdictions.

The term “public transport” refers generally to “passenger transport services of general economic interest provided to the public on a non-discriminatory and continuous basis”, as phrased by the European Union’s regulation on the same (EU 1370/2007, Article 2 (a)). That is, short and long-distance bus, rail, boat, air, and other services fulfilling these criteria.
The regulatory development of the bus industry in Sweden closely follows the regulatory cycle as formulated by Gwilliam (2008), a concept also previously discussed by Diandas and Roth (1995) and Preston (2001). Gwilliam’s (2008) cycle includes four stages for the regulatory environment of bus services - private sector area monopoly, regulated private local monopoly, regulated public monopoly, and competitive private supply. This is a similar regulatory path that Sweden has taken in other transport areas than bus traffic, such as the railway sector where supply is now also provided through competitive procurement as well as commercial transport services by both air, bus, and rail (Alexandersson, 2010). The tradition is today, arguably, a more liberal regime with more market initiatives. Today, Sweden sees competition both for the market, in terms of competitive tendering, and in the market, in terms of commercial/open-access initiatives.

Liberalization and, by extension, competition has the potential to foster innovation, which in turn can provide new market concepts and achieve ways of producing services more efficiently. An example is the US airline market for which the overall impression is that the deregulation in 1978 was a success in terms of lower fares as well as increased supply and efficiency (Goetz and Vowles, 2009). However, the authors of that study also argue that the deregulation has caused carriers to underperform financially because the market is naturally oligopolistic and that less attractive routes have not seen the same benefits from the competition in the market. The latter seems to be the current situation in Sweden following the opening of the railway market where the only major entry has been on the high-demand Stockholm-Göteborg route (Fröidh and Nelldal, 2015). The entry was in March 2015 when the Hong Kong-based operator MTR Express (MTR) started its services and thus challenged the (railway) monopoly of the state-owned operator SJ.

There are sometimes clear motivations for public intervention, for example, with the Mohring effect (Mohring, 1972; Jansson, 1979) and when coping with non-internalized externalities of transport, in which subsidies are often used to achieve a greater welfare. Because subsidies are an intervention by the public sector and have the potential to distort the private market (Graells, 2015), a transparent and non-discriminatory purchasing process and awarding mechanism is required. One of the more common in the EU is procurement through competitive tendering. Procurement in turn also requires competition to function adequately as companies compete for the market. Insufficient competition can cause similar market failures as in an ill-functioning free market - including monopoly power, lower service quality, and inefficiencies - and this indicates
that market surveillance and policy advice is necessary both here and in a more deregulated market. Too little information about the market structure, bid outcomes, and the impact of contract design risks a poorer welfare outcome.

The work in this thesis is entirely shaped by the dominant regime for public transport today with competitive tendering and open access, and it focuses on the competition in and for the market. The research questions and purposes given in the appended papers address various aspects of the competitive environment and performance of the tendered public transport bus services and the long-distance rail market. These are summarized in Section 4. The overall objectives are to investigate the competitive environment in the Swedish public transport sector. In particular, the objectives are to assess the impacts of the recent market opening in the rail market, the efficiency in the tendered bus market, and the competition situation in both markets. The main contribution of the thesis is the gathering and analysis of new and unique data for the Swedish situation, which in many respects carries over to an international context. This allows the objectives to be addressed on a more disaggregate level than before and thus for more detailed policy advice to be given.

2 Market outcomes and regulatory environments

As noted previously, the overall aim for regulatory interventions, whether it is imposing or relaxing regulations, is arguably to enhance the welfare outcome. In order to formalize this way of thinking, a “regulatory curve” as suggested by van de Velde and Preston (2013) is useful. The curve is illustrated in Figure 1, and was based on Figure 2 in van de Velde and Preston (2013). The basic idea is that there exists some “optimal” amount and type of prescription to the market so that the best outcome (welfare) is achieved. This prescription could be different types of regulation, industry standards, or contract design elements. Interventions in the market can then be benchmarked to this curve to assess where one stands today and where one is heading. This sort of benchmarking can be made in terms of the amount of prescription, but more importantly in terms of the outcome. An important point is also that going from a very regulated market, often with many prescriptions, to a more deregulated market does not necessarily mean a better outcome (higher welfare). One might just arrive at the same outcome level on the curve, but on the other side of the optimal amount of prescription. It is important to note that interventions could
The outcome is not only shaped in the longer run by legislative regulatory changes, but also in the shorter run by how contract design factors are used. In the case of bus tenders, contract design factors can be viewed as a form of regulation or prescription imposed by the PTAs on the operators. At the same time, this contract design is probably prescribed in order to achieve better outcomes for the public transport service. While these factors can be an artifact of legislation, for example, requiring bus operators to equip buses running in a contract with seat belts, many factors imposed voluntarily by the PTAs can affect the outcome, not seldom in unknown directions if ex-post information is uncertain. This issue relates to the theory on incomplete contracts (Hart and Moore, 1988), and the observation that auctions (like competitive tendering) do not necessarily perform well with complex or incomplete contract designs (Bajari et al., 2008). Services provided by contracted actors can be further problematic when non-contractible cost reductions have
serious negative effects on non-penalized quality factors (Hart et al., 1997). In addition, concepts such as information asymmetries between the PTA and the operator, and between operators, could well affect the outcome in terms of cost or service provision.

Because the outcome of a regulatory environment or a contract is affected by its design, the design is important to evaluate and study both by the authority and by researchers. Policy implications for public transport can certainly be drawn from studies in other sectors, and outcomes to some extent can be inferred. For example, the study by Lundberg et al. (2015) concluded that the inclusion of green criteria has limited effectiveness as an environmental policy measure when studying tenders of Swedish internal regular cleaning contracts. Or that favoring targeted companies (for example, small or local companies) reduces efficiency and revenue as Athey et al. (2013) show using timber sales data. Policy makers in transport can indeed learn from this. Still, while policy advice can be inferred from other sectors, evaluation in the relevant sector is still necessary. In the end, research and evaluation is needed to know in which direction the transport market is moving on the outcome axis, and what interventions might be necessary to achieve better outcomes in the future. For such empirical studies, transparency is required and data need to be available and of good quality.

3 Data availability

Statistical methodology and computing capacity are hardly the main limitations for performing policy evaluation and research today. Rather, it is the availability of data, which varies depending on country and transport mode. van de Velde (2015) notes that the data situation for public transport in most countries is generally poor in terms of availability, extent, and quality. This in turn hinders good analysis.

While quantitative analysis has indeed been conducted both on contractual variables and efficiency in subsidized tendered public transport, it is clear that data availability depends on the intended research. Generally, in many countries there seems to be good availability of operator-related data such as company expenses and to some extent their kilometers produced. These operator data are often used in econometric studies on technical efficiency (Farsi et al., 2005; Roy and Yvrande-Billon, 2007; Obeng, 2013; Jarboui et al., 2014) and cost efficiency (Filippini and Prioni, 1994; Farsi et al., 2006; Walter, 2011; Sakano and Obeng, 2012; Jarboui et al., 2013),
all of which almost exclusively use operator data. These data are to a large extent available through published surveys and public statistics in Germany, France, Italy, and the US. Dalen and Gómez-Lobo (2003) and Piacenza (2006) compiled operator data themselves in order to analyze competition and ownership efficiencies. The number of studies including more contract-related variables is smaller, but there are a few examples on contract data for Germany, Italy, and the Netherlands (Amaral et al., 2013; Augustin and Walter, 2010; Beck and Walter, 2013; Veeneman et al., 2014; Avenali et al., 2016, 2017), and on both contract and award data for London (Cantillon and Pesendorfer, 2006; Iossa and Waterson, 2017). Common for most of these studies is, however, that the data is limited in scope; the data is mostly collected through a survey and/or only for some variables, which means that not all information on the tender is necessarily available. This limitation is not unsurprising, however, because the collection of such data is time consuming and difficult work.

For the commercial markets in most of Europe, including Sweden, data is arguably even scarcer than for tendered public transport and are often next to non-existent. This scarcity includes both information on ticket prices (fares) and numbers of passengers. However, at least for Sweden, there is detailed information regarding supply in terms of timetable data on departures and arrivals that is available from Samtrafiken’s GTFS data (General Transit Feed Specification). Compared to the case with subsidized transport, this lack of detailed information is perhaps not very surprising because such information is potentially sensitive corporate information. Still, the data is needed in order to monitor the market and, perhaps more importantly, to evaluate policy reforms. The liberalization of passenger railway services in Europe has meant more open access competition in some countries, but empirical evaluations on the impacts and welfare effects of the same are limited. Some literature simulating competition exists and indicates positive social welfare effects of increased competition (Preston et al., 1999; Preston, 2008; Preston and Robins, 2013; Johnson and Nash, 2012). The applied literature looking at the effects of price competition is limited, and literature on the effects on demand are arguably non-existent on more disaggregate levels. Because train operators sell their tickets online, some recent papers have used web crawlers to obtain price data for analyses using both descriptive (Tomeš et al., 2014, 2016) and regression techniques (Bergantino et al., 2015; Beria et al., 2016).
For this thesis, two main data sources were collected and compiled - one with contract information on bus tenders, and one with ticket prices of rail operators. In relation to the previous data used in the two transport markets, these new datasets are unique both in their extent and their level of detail. These data have also allowed for the more detailed investigation of the Swedish public transport market than has previously been possible.

The contract data contain detailed information on bus tenders carried out by the Swedish PTAs, both with regard to the contract setup and the tender awarding. These data were used in Papers II and III, and a more detailed description is found in Paper II. The collected material is essentially the enquiry documentation and the awarding protocol of all tenders for bus contracts that were active in Sweden in December 2015. That is, the ex-ante information from the tenders. Because the enquiry documents were collected, all information about the setup of the contract and the traffic to be run is available, which allowed for the specification of a wide range of variables. Similar efforts for Sweden were made in Nilsson (2011) and Hultén (2015), but those attempts fell short, and obstacles like the ones encountered in this paper were met. One of the major obstacles, and perhaps the most serious, was poor compliance with the principle of public access to official
documents\(^2\). Because enquiry documents and awarding protocols are public information, and because PTAs are subject to the principle of public access, requests to access this material must be administered in a timely manner (skyndsamt), and refusal to provide access to the information must be motivated by reference to applicable paragraphs in national legislation (SFS 1949:105, Chapter 2). In attempting to collect the contract data for this thesis, requests were made to the PTAs in order to acquire enquiry documents and awarding protocols of previous tenders. Many PTAs simply did not respond to the request(s), claimed the information was subject to corporate secrecy (mostly with regard to placed bids), or claimed the information was lost. Despite this, the tender documentation was eventually acquired. Figure 2 illustrates another obstacle, that many of the 20 asked PTAs failed to administer the requests in a *timely manner*. The solid line shows the accumulated number of PTAs relative to the number of days before they delivered requested documentation, and the dotted line shows the 14-day mark. In most cases, 14 days should be considered a “timely manner”, at least for these requests, although some leeway must, of course, be given depending on the size of the request. Only eight PTAs returned the complete documentation in two weeks’ time. What is even more worrying is that five PTAs took 100 days or more to hand over the information, even after repeated requests, which should be in clear violation of the principle of public access. This is a prime example of why data and publications on contract design are relatively scarce; few researchers have the time or energy required to follow up on the data requests.

The second data set compiled is on ticket prices for commercial passenger railway. Like the previous studies on price changes following the onset of competition in Europe, a web-crawler approach was used for this thesis, and a Python program was written for this purpose. This program requested price information from the websites for departures of the Swedish state-owned incumbent railway operator SJ and the entry operator MTR between July 2014 and June 2016. More details on the price collection and the content of the data is available in Paper IV. The data is unique in the passenger railway research field both in its richness (including price information on most departures up to 31 days before departure) and that it include six separate lines, of which five did not see entry during the sample period. However, perhaps most importantly, it is especially

\(^2\)More information on the principle of public access to official documents can be found at http://www.government.se/how-sweden-is-governed/the-principle-of-public-access-to-official-documents/
rich because it spans both the pre- and post-entry periods of MTR on the Stockholm-Gothenburg line. This allowed for a before-and-after analysis of the (short-run) effects of the entry on price. The dataset holds a total of 2.15 million observations.

As already noted, market data on commercial transport operations in Europe are scarce. There are, however, some sources that are worth mentioning and that can serve as role models for improving the data situation. van de Velde (2015) notes good examples in the regional public transport data collected by the Department for Transport in Great Britain and by the US Department of Transportation. Studies mentioned earlier also suggest that data is available on operators, but not contracts, in both Germany and Switzerland. For railway services, the United Kingdom is again a good example in also providing (posted) fare data for the integrated ticketing and fares system of franchised train operators (Rail Delivery Group, 2017). However, the perhaps most extensive data source with both fare and passenger data is the Airline Origin and Destination survey (DB1B) provided by the Bureau of Transportation Statistics at the US Department of Transportation. The survey conducted quarterly since 1993 is a 10 percent sample of tickets sold by all airlines in the US and contains itinerary details such as route flown, fare, and fare class. Because of its richness both in variables and time, it has allowed for extensive analyses of policies (Goetz and Vowles, 2009; Ciliberto and Williams, 2010; Aguirregabiria and Ho, 2012), and competition in the airline market (Goolsbee and Syverson, 2008; Brueckner et al., 2013; Luo, 2014), and has been important for methodology development. This is arguably an example where the public accessibility of data can benefit both researchers and policy makers.

In Paper I, a third data source was used - the contract collection ("Avtalsinsamlingen"). Transport Analysis sent out questionnaires to each of the 21 PTAs in Sweden, asking for information and data on their running contracts. These data contain information on contract payments the PTAs have made in their respective tendered contracts as well as some variables related to contract design. The main difference compared to the enquiry document data used in Papers II and III is that these are ex-post data. The data currently span 2010-2015, but the quality is questionable for the years 2010-2012. This type of data is arguably more useful for estimations of performance than the contract data with the bids. The reason for this is that bids placed for tenders are merely estimates of what the traffic will cost and do not necessarily reveal, for example, inefficiencies. At the time of writing this thesis, however, it seems that Transport
Analysis is no longer going to collect such data. In addition, PTAs are obliged to make available similar data, in accordance with EU-regulation (EU 1370/2007), but few PTAs comply with this (Transport Analysis, 2015).

A data source that was utilized in Papers II, III, and IV, and that was already available, was Samtrafiken’s GTFS data, which essentially is the timetables for public transport lines in Swedish public transport. All operators except airlines, both private and public, must report their supply to this database, which is available for free through trafiklab.se and Samtrafiken. The GTFS data also contain geographical information on all stops. This is what makes it possible to map the contract data (containing information on which bus lines are included in each contract) to a geographic dimension in Papers II and III. By doing this, more data sources could be used along with the contract data, for example, the operator workplace data from Statistics Sweden used in or population density data.

4 Contributions and summary of papers

The common denominator for all of the included papers is that they all deal, in one way or another, with competition in the public transport sector. While Papers I, II, and III study the tendering market of subsidized regional public bus services, the fourth covers on-track competition in the passenger railway market. That is, the first three are about various aspects of competition for the market, while the fourth is about competition in the market. The order of the papers in this thesis has been made with respect to what would be the natural order of reading. In a chronological order of writing, however, paper IV lies in between papers I and II.

The first contribution lies in having acquired and used new and relevant contract tender and price data in public transport for economic analysis. As discussed in the previous sections, this information is scarce both in Sweden and internationally. The collected data is rich in scope, allowing for more detailed research than previous studies. Given the opportunity to work with more detailed data, more knowledge has been gained on the issues of public transport tendering and open access competition in railway markets.
Paper I. Cost Efficiency in Swedish Public Transport

Sweden has been procuring public transport services for almost 30 years, and both the PTAs and operators have gained much experience in the process during this time. The costs for providing the services have, however, increased substantially and more rapidly over the last decade than the increase in supply and in the number of trips (Transport Analysis, 2017). There is also little knowledge about what has caused this, or of what factors affect cost efficiency in general. Paper I studies the latter and looks at the impact on cost efficiency of contractual and operational environment factors for Swedish bus contracts. It also compares this cost efficiency across PTAs (counties).

To do this, the paper employed a stochastic frontier methodology, which aimed at estimating a cost frontier and attributed some of the deviations from the frontier as inefficiencies. The method is well established both in the public transport (Farsi et al., 2006; Holmgren, 2013) and other fields (Kumbhakar et al., 2015) as a way of estimating inefficiencies across units and of identifying factors that affect the level of efficiency. The data used in the analysis were the contract collection data (“Avtalsinsamlingen”) provided by Transport Analysis, as described above. This dataset contains ex-post information mainly on production and costs in the PTAs’ respective tendered contracts, but also some information on the contract design and the operators. As argued previously, ex-post data is assumed to be more appropriate for analyzing performance than are ex-ante data. The dataset covers all 21 PTAs for the year 2013 and includes 280 gross cost and incentives contracts. Also, data on operators’ labor and capital costs were mapped with that data from the operators’ respective annual reports and from the Swedish vehicle registry.

The main results from the estimations show that a higher population density in the contract area reduces cost efficiency. Similarly, traffic operated by an in-house operator (that is, the traffic is not put out for tender) is also less efficient. Both results are in line with the previous literature on the subject (Walter, 2011; Piacenza, 2006; Ottoz et al., 2009). The rest of the included contract variables (contract term, the contract being operated by a large operator, and the use of incentive payments) have no statistically significant effect on performance. The last result, that including incentive payments has no statistically significant effect on cost efficiency compared to gross-cost contracts, is positive for the use of the contract form, but the causal effect that incentives have on attracting more passengers must be studied in more detail.
The cost efficiency scores across PTAs do not differ more than marginally, and the difference between the highest and 18th highest score is merely six percentage points. This implies fairly similar efficiency across Sweden. The two counties of Skåne and Stockholm, however, see slightly lower estimates than the others. These are also the densest counties. Finally, the county of Västmanland has a substantially lower efficiency score than the country average, a potential explanation being that they run all traffic with their in-house operator.

**Paper II. How Many Want to Drive the Bus?**

While paper I focuses on performance of the running public transport services, the tender design and competition for the contracts is considered in Paper II. One relevant measure of competition is the number of bidders a PTA sees in their tenders, which varies substantially both across and within PTAs. This motivated the study in Paper II, which sought to determine how factors relating to contract design and the operational environment affect the number of bids for tendered contracts. Because of the lack of data in the Swedish public transport sectors, studies on competition are scarce as well. Internationally, previous studies are also few, or use more limited data than were used in this paper (Augustin and Walter, 2010; Beck, 2011; Amaral et al., 2013).

The analysis used the contract data described above that were collected from the individual PTAs, and the number of bidders could be determined from the detailed data on how 268 contracts tendered between 2007-2015 were constructed. Further, along with GTFS data and workplace data from Statistics Sweden, the transport supply and local competitive environment could also be inferred and be included as suitable variables in the analysis. Because the contracts state what bus lines are included, the geographical line information from the GTFS data could be used to construct the contract areas. Because the outcome (the number of bids) is an integer variable, a Poisson regression model was appropriate. Furthermore, because none of the contracts see zero bids and the dependent variable is underdispersed, a zero-truncated generalized Poisson model was used for the analysis (Consul, 1989; Winkelmann, 2013).

The overall result is that most factors included in the analysis change the number of bidders only by some 0.1-0.5 bidders. This means that the single PTA has few direct measures to use when attempting to design their contracts to increase the number of bidders substantially. The largest impact found was on how many other tenders are put out at the same time as the PTA’s
specific tender. That is, the number of simultaneous tenders, which has a clearly negative effect and can reduce the number of bidders by almost two bidders. This would mean that PTAs should organize their tenders so that the asking time does not overlap for too many tenders, nor should they tender too many large contracts simultaneously. The local competitive environment in terms of the number of potential bidders on the contract was found to affect the outcome positively, which means competition is not only a national-level matter.

Three variables indicating if the PTA added special requirements in how the operator conduct the traffic was added to the model, and all estimates indicate that all three variables have a negative effect: fuel requirements, forcing the operator to use a specific depot, or imposing overtakes of existing vehicles on the winning operator. Although the effect of the individual requirements was estimated, the result should be interpreted more generally; that including special requirements and thereby restricting operator freedom lowers the number of bidders. This is also something the industry has worked on for some time, constructing industry-wide recommendations for contract design and the use of special requirements in the organization “Partnersamverkan för Förbättrad Kollektivtrafik”.

Finally, the distinction between forcing a depot on an operator and only giving the operator the option to use it was also found to matter for the result. While the former decreases the number of bidders, the latter does not. This could be a consequence of small operators often having their own depot in the local area and thus not participating in the tender if they would be forced to use another depot for the contracted traffic and thus having to take on double costs for such facilities.

*Paper II received an honorable mention at the Thredbo 15 conference in Stockholm in August 2017.*

**Paper III. The Distance Factor in Bus Contracts**

Building on a result from Paper II, that the local competitive environment has an impact on the number of bids per contract, Paper III sought to investigate this finding in more detail. Previous studies have found a negative relationship between a company’s distance from the contract area and its propensity to participate in the bidding process in general (Jofre-Bonet and Pesendorfer, 2003; Bajari and Ye, 2003), and specifically in bus tenders (Cantillon and Pesendorfer, 2006).
The magnitude and importance of the distance factor has, however, not been investigated further. The issue is that of dead running, which is the distance the operator has to run its buses between the depot and line. They are not paid for this distance, and therefore want to reduce it as much as possible (Preston, 2008; Hensher et al., 2013) The purpose of this paper was therefore to investigate the impact of operators’ distance from contracts on their probability of participating in tenders, consider differences in this probability across operator types, as well as what effect there might be of including depots in the contract.

Using data from Statistics Sweden with information on all Swedish operators’ workplaces (for example, a depot) for the years 2007-2015, each operator’s workplace was identified for each year, and the corresponding distances from the contract were calculated using GIS methods. Thus, the observational unit was at the operator-workplace level. The contract area was constructed using GTFS supply data, which give coordinates for all stops along the lines of the contract. Line information was available in the contract data used for Paper II. Because an operator can have multiple workplaces, the distance variable was calculated as the median distance from an operator’s closest workplace to each line in the tendered contract in question. This is intended to represent the dead running for the operator were it to win the contract. Control variables for factors relating to the contract and operating environment were also included using the contract data. Using a probit regression model, the outcome variable takes the value 1 when an operator places a bid in a tender, and 0 otherwise. Two variables are in focus of the paper; the operator’s own (median) distance to the contract, and the second closest (to the contract) operator’s distance (called the rival’s distance).

The results show a negative effect of distance on operators’ decisions to participate, which is in line with the results of Cantillon and Pesendorfer (2007), and that an operator is more likely to participate if the second closest operator is farther away from the contract area. Investigating the marginal effects shows that being directly next to a contract area implies an almost 100 percent chance of placing a bid, but that this probability decreases substantially with distance. With a dead-running distance of, on average, 2 kilometers, the probability is down to 70 percent, while being 10 kilometers away reduces the probability to 30 percent. This confirms what was partly established in Paper II, that the local competitive environment matters. The PTAs must consider what impacts their geographical decisions on contract design have, and not simply tender lines
in the same contract areas as they did 20 years ago, which is sometimes the case. The rival’s distance to the contract has some effect, but the most important effect is the operator’s own distance to the contract.

Large operators are less affected by their distance from the contract area when deciding whether to participate, compared to other smaller operators and compared to cooperation companies (co-ops). The large operators are also more inclined to place a bid if a depot is offered for use in the contract, which is not the case for the rest of the operators.

**Paper IV. Competition in Swedish Passenger Railway**

In line with the deregulation and liberalization path of the railway sector in Sweden, and to some extent the rest of Europe, Sweden was one of the first countries to impose open access competition on the passenger railway market. Starting with night trains and charter traffic in 2007, the market was gradually fully opened for commercial traffic in 2010 (Alexandersson, 2010). The market opening led to new traffic only on a few minor routes or with niche services (Fröidh and Nelldal, 2015). However, a substantial entry occurred in March 2015 when the Hong Kong-based operator MTR started running services on the Stockholm-Gothenburg line. This paper investigates whether the entry on the line has lowered ticket prices faced by travelers.

Swedish railway market data is scarce, if not non-existent, as noted above. Therefore, for this paper, a Python-scripted web crawler was created to collect price information from the Internet on SJ and MTR trains. The program collected the lowest available price for almost all departures on six Swedish routes from July 2014 to June 2016. The price request was also made for each departure and day up to 31 days before the departure. This created a rich dataset, both in terms of the number of lines and departures, but also over time. Because the dataset spans the pre- and post-entry period of MTR, these factors arguably make the data unique not only in a Swedish, but also international context. Beria et al. (2016) use similar data for Italy, but for a shorter pre-entry period and for only a single line.

Because price data is available for the (treated) Stockholm-Gothenburg line, as well as for five other lines (controls), a difference-in-difference approach can be used to identify the price effect following MTR’s entry. The identification strategy is that the price development on the treated line should behave similarly as the control lines if the entry would not have occurred. The
difference between the treated and control groups is therefore the price change following MTR’s entry. This is also known as the parallel-path assumption (Angrist and Pischke, 2008), and this is a tested and validated assumption.

The results show that following the entry of MTR the average price for the incumbent SJ on the Stockholm-Gothenburg line as of June 2016 was 12.6 percent lower compared to the average price prior to MTR’s entry. The prices for MTR were shown to be systematically around 100 SEK lower on average than the average SJ prices. Therefore, the consumers are facing lower prices than before the entry. The largest price reduction for SJ was found for 13 days before departure (a decrease of 13.8 percent), while the smallest was 31 days before departure (a 9.4 percent decrease). Finally, the price change occurred gradually over the 15-month period after the entry and was not an immediate downward change.

The mechanisms behind the incumbent’s price decrease are, however, not possible to infer from the collected data. Two explanations are plausible - an active price adjustment by the incumbent, or the price decrease being a consequence of a dynamic pricing system adjusting for fewer passengers. It is argued in the paper that the latter is the more likely explanation. Further, this paper analyzes the short-run effect of competition, and the current data cannot answer whether the price decrease will remain stable or if it will decrease further or even increase again in the future.

5 Conclusions

As noted by Gwilliam (2008), the regulatory cycle is seldom completed in the sense that a state returns to its initial position in the cycle. Thus, the next step in the cycle for Sweden is not necessarily that towards private sector area monopolies. Swedish public transport in general is currently in a situation with competitive private supply, both in the subsidized regional public transport services and in passenger railway services. The more liberalized markets have arguably aimed at taking Sweden from the right-hand side of the regulatory curve in Figure 1 and more towards the left. As for the market opening in railway transport, the results in paper IV where prices were found to be lower after MTR’s entry suggest that this reform has improved the welfare outcome, given that price and supply are the most important factors. Quality of service is also an issue, but there is, as far as the author of this thesis is aware, no evidence that quality has
decreased on the line. Tomeš et al. (2014) noted quality improvements in the Czech Republic following open access competition, but the long-term effects of the open access regime in Sweden are yet to be determined.

One of the overall conclusions in Paper II is that there are few single measures that PTAs can use to substantially increase the number of bidders. However, one thing they can do is to lower the number of simultaneous tenders. Still, it is not irrelevant how the PTAs design their contracts. Some contract design factors do in fact have a statistically significant effect, and the PTAs should therefore still consider what impact their contract specifications can have on outcome variables such as costs, patronage, social welfare, and the competitive environment, and combining many contract design variables simultaneously might achieve better bidding outcomes. The combined results of Papers II and III show that the contract area can have an impact participation and the number of bids seen, which in turn affects the outcome variables. The way in which special requirements are imposed in the contracts also affects the behavior of operators, especially in terms of the costs to meet the requirements (Camén and Lidestam, 2016), and this must be weighed against the intended benefits of the same requirements.

The current competitive tendering regime in Sweden is, arguably, rather uncontested and is supported by the EU regulations on public transport (EU 1370/2007). EU and Swedish law does, however, allow traffic to be run in-house by a publicly owned operator. The in-house alternative has received more attention in recent years, most notably in the counties of Örebro and Jämtland who both have investigated the issue because they are experiencing low quality and cost increases, but they have limited possibilities to adjust the traffic with the tendering regime and have little competition in their respective markets (Region Jämtland Härjedalen, 2016; Region Örebro län, 2016). The last concern is discussed to some extent in Papers II and III, but is also raised in Mathisen and Solvoll (2008) and Mathisen (2016) where structural changes and ownership links in the operator market following tendering are discussed. The discussion on co-ops in Paper III is also relevant here because these could increase competition, as well as lower it. While the region of Jämtland Härjedalen decided not to implement in-house operations, the region of Örebro will start insourcing public transport operations in 2019 when some of the region’s current contracts expire. This is a step towards the regulated public monopoly on Gwilliam’s (2008) regulatory cycle, which is in the opposite direction of the joint work through the “Partnersamverkan för
Förbättrad Kollektivtrafik” to enhance tenders and the direction of legislative developments, which in 2012 liberalized the public transport market for commercial actors to provide traffic within counties\(^3\). The arguments for going in the opposite direction and the arguments for continuing to use competitive tendering are also similar - quality while curbing cost increases. The contrasts are perhaps best illustrated in the regulatory curve where both regimes aim at reaching the optimal level of prescription, but are approaching it from different sides of the optimum. The results from Paper I, and other studies for Europe, suggest that the in-house regime is less cost efficient, and will, all else being equal, not yield improved welfare. The difference in quality between the tendering and in-house regimes is, however, not well explored in the transport literature. The argument for competitive tendering is that quality control can be imposed in the contracts, while the counter-argument would be that the PTA then does not have the ability to make changes to the service during the contract period and that such adjustments can be made more easily with an in-house regime. This issue calls for more empirical research, for which the Örebro case would be interesting to follow.

The in-house regime is one direction the future of public transport regulation can take. Procurement through competitive tendering is not likely to be abandoned soon, but the research literature has been concerned with its potential deficiencies. Yvrande-Billon (2006) argues that the success of competitive tendering relies on transparency. Among others, Hensher and Stanley (2008) argue for increased use of negotiated performance-based contracts (NPBCs) to accommodate situations with high transaction costs and few bidders, and this is a contract form where the operators receive a subsidy per kilometer driven and receive incentive payments relating to key performance indicators (KPIs). This would tend to steer the operator’s behavior towards higher quality and better service from the societal point of view (Hensher and Stanley, 2003). A crucial part of the NPBC, argue Hensher and Stanley, is also that the contract is negotiated between the relevant parties (most importantly the PTA and the operator(s)) to “create” the service, rather than “determining” it as in the case of competitive tendering (Hensher, 2015). For this, trust between the actors and open books are necessary. Ultimately, if agreements are hard to reach, the PTA always has the threat of tendering the service (Hensher, 2015). This is not very different from some performance based-like contracts (for example, incentives contracts or gross

\(^3\)The new law has yet not had any substantial impact on the establishment of new lines by commercial operators (Transport Analysis, 2013).
cost contracts with incentives) that are already used in Sweden. The main difference is the negotiation part. A transparent process is, however, necessary, and all relevant parties must be included in order to fulfill the important principle of equal treatment in public procurements.

Finally, what has been much of the focus in this thesis is the public availability of data. This situation must improve. The data collection undertaken for this thesis has proven that it is possible to acquire this information, and it has shown how such information can be put to use. Regarding public transport tenders, the situation illustrated in Figure 2 is not acceptable with close to one year until full enquiry documentation and awarding protocols were sent out by some of the PTAs. References to corporate secrecy (företagshemligheter) were often claimed by the PTAs, which is also worrying. In many cases, the bid sums and evaluations, which decide the contract winner, were claimed to potentially hurt the bidder or reduce the chances of future bids. However, not being able to evaluate the tendering and bidding process must be in clear violation of the principle of public access to official documents, which in turn limits the possibility for the public to claim responsibility over the public sector. Evaluation and research on the public transport area is an important contribution to enhancing the welfare outcome in the Swedish transport sector, irrespective of the level of prescription, but such research is only possible with transparency and good data availability. Finally, van de Velde (2015) makes the important point that “Researchers need to avoid playing down the importance of this issue [data availability and quality, authors note] in this sector in order to guarantee the quality of quantitative research”. 


