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Competitive Procurement Design: Evidence from Regional Passenger Railway Services in Germany

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Non-technical summary

A major reform of the German regional passenger railway services was established with the so called Regionalisierungsgesetz in 1996. As a consequence, regional passenger railway services have been procured by regional public agencies from railway companies since then. A central goal of this reform was the establishment of a competitive transport market.

In this article we study the competitive awarding procedures of the years since the reform by means of a new data set. The procurement agencies design the awarding procedures in different manners such that the question arises which design yields better awarding results. Among others, the design includes the contract duration as well as the revenue risk sharing between agency and operator. We investigate how the design parameters influence how many railway companies participate in a tender, which of them wins the contract and which price the agency has to pay.

Our results indicate that more companies participate in an awarding procedure when the contract duration is long and when the company's revenue risks are low. The market leader DB Regio is more likely to win contracts when it already served the awarded lines in the past and when the line network is long. Moreover, DB Regio is more likely to win contracts with a long runtime, when used vehicles are allowed and when fewer competitors participate in the awarding procedure. Concerning the resulting payments of the agencies our only robust finding is that the agencies have to pay less if they do not receive the ticket revenue realized by the railway companies.

In the following years a large fraction of the regional passenger railway network is to be procured. Our results can be applied in order to enhance the performance of the upcoming awarding procedures.

Das Wichtigste in Kürze

Mit dem Inkrafttreten des Regionalisierungsgesetzes im Jahre 1996 wurde der Schienenpersonenverkehr in Deutschland grundlegend reformiert. Seitdem werden Schienenpersonennahverkehre von regionalen Aufgabenträgern bei Verkehrsunternehmen bestellt. Ein zentrales Ziel der Reform war die Schaffung eines wettbewerblich organisierten Verkehrsmarktes unter Berücksichtigung der Daseinsvorsorge.

In diesem Artikel studieren wir anhand eines neuen Datensatzes die wettbewerblichen Vergabeverfahren der seit der Reform vergangenen Jahre. Diese werden von den verschiedenen Aufgabenträgern unterschiedlich gestaltet, weshalb sich die Frage stellt, welche Gestaltungsparameter, dazu gehören die Vertragslaufzeit und die Verteilung der Erlösrisiken zwischen Aufgabenträger und Verkehrsunternehmen, zu besseren Vergabeergebnissen führen. Daher untersuchen wir, wie sich die Gestaltungsparameter darauf auswirken, wie viele konkurrierende Verkehrsunternehmen an einem Vergabeverfahren teilnehmen, welches von diesen das Vergabeverfahren gewinnt und wie viel Bestellerentgelt der Aufgabenträger dem Verkehrsunternehmen schließlich zahlen muss.

Unsere Ergebnisse deuten darauf hin, dass mehr Unternehmen an einem Vergabeverfahren teilnehmen, wenn der Verkehrsauftrag eine lange Laufzeit hat und wenn die Erlösrisiken gering sind. Der Marktführer DB Regio ist eher geneigt Verträge zu gewinnen, wenn er die Strecken bereits in der Vergangenheit bedient hat und wenn das Streckennetz groß ist. Außerdem gewinnt DB Regio eher Verträge mit langer Laufzeit, wenn Altfahrzeuge zugelassen sind und wenn weniger Wettbewerber am Vergabeverfahren teilnehmen. Bezüglich des zu zahlenden Bestellerentgelts stellt sich lediglich heraus, dass die Agentur dem Verkehrsunternehmen weniger zahlen muss, wenn die Fahrkartenerlöse nicht der Agentur zufließen.

In den kommenden Jahren wird ein großer Teil des deutschen Schienenpersonennahverkehrs ausgeschrieben. Diese Ergebnisse können als Anhaltspunkt für die Neugestaltung der vielen in den kommenden Jahren anstehenden Vergabeverfahren verwendet werden.

Competitive procurement design: Evidence from regional passenger railway services in Germany*

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Abstract

We study competitive awarding procedures of short haul railway passenger services in Germany from 1995 to 2011 by means of a newly collected data set. In particular, we use regression techniques to investigate the determinants of the number of bidders, the identity of the winning bidder and the subsidy level. We find that there are more bidders when the contract duration is high and the revenue risk low. The dominant operator is more likely to win contracts if it is the incumbent, the network is large, the contract duration is high, when used rolling stock is admitted and when there are few other bidders.

JEL classification: D44, H57, L92
Keywords: competitive tendering, market entry, networks, public procurement, railroads

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1 Introduction

Competitive tendering of regional railroad passenger services in Germany has developed since the liberalization of the railroad sector in 1994. The central goal is to implement a decent level of service quality, while keeping public subsidies at a low level. Towards this, an intermediate goal is to induce entry of new operators that provide alternatives to the still dominant operator DB Regio. This operator is not only the incumbent of most transport services, but is additionally integrated with the network operator in the publicly owned holding Deutsche Bahn AG (DB). Reinforced by substantial asymmetries between the incumbent and the entrants, designing awarding procedures that attract an adequate number of bidders and select the most capable one remains a challenge.

In this paper, we study how design options affect participation of bidders in competitive awarding procedures, and in turn the resulting procurement price as well as the likelihood that the dominant operator is awarded the contract. We use a newly collected data set on (almost) all of the around 190 competitive awardings of public regional passenger railroad services in Germany since the first one in 1995 to the end of 2011. An important source of cross-sectional variation is caused by the fact that there are 27 public regional procurement agencies, which differ substantially in how they design their awarding procedures. Major differences include the contract duration and its volume (network size, frequency of service), various factors influencing the distribution of residual profit claims among the contracting parties, and the procurement mode (open tenders and less formal restricted tenders).

For our analysis we use plain ordinary least squares regressions, as well as count data and discrete choice models, and test for endogeneity of relevant variables. Our econometric analysis reveals that there are more bidders in tenders involving less risk on the operator's side and higher contract durations. The dominant operator DB is more likely to win if the number of bidders is low and contract volumes are large. Moreover, DB is much more likely to win if it was the previous operator of the services.

The econometric results confirm the expectation that the design of awarding procedures influences participation in tenders and, furthermore, the chance of new operators to win the contract. In the next years numerous competitive tenders are scheduled (BAG-SPNV 2011). There is doubt on whether several bidders can be found for each tender (FAZ 2011) and whether competitive pressure will be sufficiently high (Monopolkommission 2011). These insights may be used for redesigning awarding procedures. For a thorough analysis of the procurement price, however, a more comprehensive database than the one we have been able to collect is necessary.

In the next section, we discuss related literature. In Section 3, we briefly present the institutional background as well as the recent development of the public procurement of regional passenger railway services in Germany. We develop our hypotheses in Section 4. The data sources and variables are introduced in Section 5, followed by the econometric analysis in Section 6 and concluding remarks in Section 7.

2 Related literature

Link and Merkert (2011) present a survey on factors and problems relevant for competitive tendering in the German SPNV. They note that comprehensive empirical evidence on competitive tendering in German regional passenger transport is still rare due to the lack of available data. By means of a new database, we contribute to fill the research gap on the German SPNV. We included the numerous recent tenders as well as more variables to explain the participation in tenders, the likelihood that the dominant operator is awarded a contract and the resulting subsidy levels.

There are only very few studies on the design of competitive tendering in the German SPNV. Lalive and Schmutzler (2008a) examine 77 competitive tenders of the years 1997-2005 with respect to the likelihood that DB is awarded the contract. They find that DB is more likely to win competitive tenders of large networks. Furthermore, DB is found to have been more successful before the year 2000 than afterward. Beck (2011) studies 30 open tenders that took place between 1997 and 2007 with respect to potential barriers to entry for new operators. He finds a negative correlation between the number of bidders and the operators' profit risks. Beck motivates the negative correlation with a potential risk aversion of small operators. However, he notes that his sample of only 30 tenders is very small and a more complete study of particularly more recent tenders is highly desirable.

Nash and Wolanski (2010) provide an overview on the outcomes of competitive tendering in recently liberalized public rail and bus sectors. They emphasize that careful attention needs to be paid to the design of tendering exercises, details of the contract and risk-sharing arrangements. With our study, we confirm that these factors are indeed important in German rail services.

The importance of the design of awarding procedures is also emphasized by Amaral et al. (2009) who argue that the French procedures are conducive to both corruption and collusion. The latter is supported by the fact that the big three operators were fined for collusive behavior in 2005. In a recent study, Frot et al. (2012) find that competition has become more intense since 2005, but that incumbency advantages in tenders are correlated with local political majorities, suggesting that ideology biases the market outcomes. Yet for Germany, Lalive and Schmutzler (2008a) do not find a relationship between political majorities and competitive tendering.

The reported effects of competitive tendering on the outcomes such as required subsidies and service quality are mixed. Whereas Boitani and Cambini (2006) find that there are no savings due to competitive tendering in Italian bus markets and attribute this mainly to a poor auction design, Hensher and Wallis (2005) report savings of around 20 to 55% for several European countries. However, these results may be due to first round effects. For Germany, Lalive and Schmutzler (2008b, 2011) employ a difference-in-difference approach to find that the service level on lines that were competitively tendered grew more than on lines that were directly awarded (mostly to the incumbent DB), while subsidies fell correspondingly. As the results are based on a sample ranging only up two 2004, first round effects may also dominate

in the German case. Thus evaluating also the recent tenders is worthwhile.

3 Background

3.1 Institutional setting

The EU Directive 91/440 *Development of the Community's railways* was implemented into German law through the so-called *Eisenbahnneuordnungsgesetz* in 1993. A primary goal of this reform was to liberalize the railway sector and to induce competition.

As part of this reform the former state monopolists, Deutsche Bundesbahn in West Germany and Deutsche Reichsbahn in East Germany, were merged into the Deutsche Bahn AG (DB), of which the Federal Republic of Germany until now holds all shares. DB is vertically integrated: the subsidiary DB Netz owns and runs most of the infrastructure, while other subsidiaries operate trains thereon. In order to foster competition among train operators, a non discriminatory access regime to the network infrastructure was implemented. The *Bundesnetzagentur (Federal Network Agency)* is responsible for this regulation since 2006.

A further part of the reform is the so-called *regionalisation*. Regional passenger railway transport is, in contrast to long distance passenger and freight haulage, part of the federal government's universal service obligation. It is heavily subsidized to ensure a decent level of service at low ticket prices. The goal is therefore not to induce competition *within* regional markets, but to induce competition among potential operators *for* a regional market. The obligation to mandate an operator was assigned to the federal states in 1996, who mostly delegated this task to regional procurement agencies.

The procurement agencies have significant freedom in how to procure the regional passenger services.[1] An important choice is whether to directly award a contract to a particular train operating company (operator) or to use competitive procedures, which can be subdivided in open and restricted procedures. Open procedures are similar to an auction in which interested parties submit offers including supply parameters and the demanded subsidy. Restricted procedures are less formal; the procurement agency typically negotiates with several interested operators.

Apart from the type of awarding procedure, an agency can decide on the revenue and cost sharing, the duration of the contract, and on further characteristics of the service. For example, it can specify what kind of rolling stock (vehicles) needs to be used and whether used stock is admissible. Moreover, it can decide on the frequency of the services and the networks to be procured in a lot.

In 2011, the public sector paid subsidies of about 6.8 billion Euros to the regional train operators (Holzhey et al. 2011). These payments are part of the so-called *Regionalisierungsmittel,*

[1]Some decisions may also be taken directly by a state's ministry and in some states, such as Bremen, there is not an explicit public procurement agency. We nevertheless use the term procurement agency for all these decision makers.

which the federal government raises with a fuel tax and distributes to the federal states.

3.2 Development of the awarding procedures

Before the railway reform became effective in 1996, the German regional passenger railway transport was majorly supplied by the German state monopolists. They provided a huge part of the short haul passenger services in Germany. Only a few small regional operators were active then, for example the Albtal-Verkehrs-Gesellschaft mbH.

Following the liberalization, the agencies primarily awarded contracts in direct negotiations to DB, although there was already the possibility to award competitively.[2] Notably, only a single contract was awarded competitively in 1995. In the early years, the law was often interpreted as allowing the agencies to choose whether to procure competitively or to negotiate directly with an operator. The Higher Regional Court Brandenburg confirmed this interpretation in 2003.[3]

	Non-competitive	(Mio train-km)	Competitive	(Mio train-km)
1995	0	(0.0)	1	(0.5)
1996	5	(3.8)	4	(4.7)
1997	4	(5.3)	8	(15.5)
1998	3	(2.8)	8	(8.7)
1999	1	(0.1)	8	(11.1)
2000	3	(0.8)	2	(0.6)
2001	9	(31.8)	6	(13.6)
2002	8	(3.4)	15	(21.5)
2003	8	(159.9)	11	(21.5)
2004	9	(238.2)	14	(23.7)
2005	11	(40.7)	14	(21.0)
2006	2	(2.7)	14	(28.4)
2007	5	(12.4)	16	(34.0)
2008	6	(7.3)	13	(26.1)
2009	3	(4.4)	15	(51.3)
2010	12	(23.4)	23	(67.4)
2011	1	(1.3)	9	(18.7)
Total	90	(538.4)	181	(368.2)

Source: Own calculations, see data section.
Individual awardings may be missing if they were not reported to us by the agencies.
Initial awarding following the reform is mostly missing, as is part of 2011.

Table 1: Number and total volume of direct and competitive awardings by awarding year

Compared to the about 120 million annual train kilometers awarded competitively until 2004, the volume of about 400 million train kilometers awarded non-competitively to DB in

[2] §15,2 Allgemeines Eisenbahngesetz (AEG, General Railway Law)

[3] This adjudgement followed a lawsuit of the Connex-Group against a contract between the federal state of Brandenburg and DB.

2003 and 2004 is considerable (Table 1). These so-called *large DB-contracts* of 2003 and 2004 included plans according to which parts of the network were supposed to be competitively awarded in the following years.[4]

Competitive awarding exceeded non-competitive awarding both in the number of contracts from 2002, and in overall train kilometers from 2006 on (Table 1). This trend towards competitive procurement has been reinforced by a decision of the Federal Court of Justice in 2011 according to which contracts in the regional passenger railway service in Germany have to be tendered competitively.[5] This limits the future choice of the agencies on the procurement mode in favor of competitive procedures, so their design should be of major interest.[6]

Since the railway reform came into effect, different competitors have entered the market for regional passenger railway transport. The group of competitors of DB can be split up into three subgroups. The first consists of transport companies which are active on different national markets. The largest competitor is Veolia Transdev with a share of 26.7% in the train kilometers operated by competitors (Holzhey et al. 2011). Other major firms are Keolis and Netinera Deutschland GmbH. Though Veolia Transdev is privately owned, most of the internationally active companies are publicly owned. A second group consists of regional companies, such as the Albtal-Verkehrs-Gesellschaft mbH in Karlsruhe. These companies were often already active before the railway reform, operating both transport and infrastructure in small networks. Some of them are publicly owned, such as the Hessische Landesbahn. The third group consists of few private transport companies founded after the reform, such as the Ostdeutsche Eisenbahn GmbH in 2002. Albeit very different train operators have entered the market, DB is still the dominant operator with a market share of 75.9% (measured in train kilometers operated in 2011, cf. BAG-SPNV 2011).[7]

4 Hypotheses

In this section, we develop hypotheses about the determinants of participation in a competitive awarding and the outcome of an awarding, both in terms of the winning bidder and the resulting subsidy. The hypotheses are taken to the data in Section 6.

[4]This follows §4 Abs. 3 *Verordnung über die Vergabe öffentlicher Aufträge* (VgV), the German public procurement regulation, which allows regional passenger transports to be awarded freehand, if a significant part of the contract's volume is competitively tendered during the contract's duration.

[5]Adjudication X ZB 4/1. In essence, the court judged that the optional procurement of the rail regulation (§15, 2 AEG) is inferior to the national public procurement law. This decision of the Federal Court of Justice was made after the Higher Regional Court Düsseldorf adjudicated that a contract between the agency Verkehrsverbund Rhein-Ruhr and DB did not fulfill the legal requirements of a direct awarding. This conflicted the Higher Regional Court Brandenburg, yielding a delegation to the Federal Court of Justice (cf. Rödl und Partner (2011)).

[6]Interestingly, Northrine-Westfalia already brought a request into the Bundesrat (Federal Council of Germany) to declare the possibility of direct negotiations in the regional passenger railway transport applicable following the EU-Regulation 1370/2007 before the adjugement was made.

[7]For further comparison of direct and competitive awarding see Subsection 6.4.

4.1 The identity of the winning bidder

An unbiased and well designed awarding mechanism should select the contract offer that is most attractive in terms of price and quality.[8] Under symmetric conditions, only an efficient firm should be able to profitably realize and, consequently, make such an offer. This may well be the dominant operator DB. Yet, it is noteworthy that there are inherent asymmetries between DB and its competitors for historical reasons. DB is mostly the incumbent and, moreover, vertically integrated with the infrastructure operator DB Netz. Information disadvantages on the side of newcomers as well as discriminatory behavior may cause the competitive awarding mechanism to fail such that an inefficient operator is awarded a contract. In addition, missing competitive pressure allows operators to ask for high subsidies and be lax on quality. We therefore develop hypotheses regarding competitive advantages of the dominant operator with respect to the awarding design.

Concerning profit risks, there are two potentially important asymmetries between DB and its competitors. First, larger companies may reduce their overall profit volatility by bundling different corporate activities and should therefore be able to realize smaller risk premiums at the capital market. As DB is comparatively large and the Federal Republic of Germany is still its owner, a higher idiosyncratic risk should be less expensive for DB and may therefore result in a competitive edge. Second, DB is the incumbent on most networks, owner and operator of its infrastructure as well as the supplier of traction power. This possibly causes an informational advantage concerning future revenues and costs, so less informed operators should fear to offer the most attractive contract whenever their profit expectations were excessively optimistic. This may cause them to bid less aggressively when profit risks are high, yielding

Hypothesis 1. *DB is more likely to win when profit risks are high.*

The agencies employ different policies regarding the admission of used vehicles in an awarding. As the cost share of vehicles is on average about 20 % of the operator's total costs (BAG-SPNV 2010), vehicle costs are a major determinant of its competitiveness. The admission of used vehicles may cause a competitive advantage for DB because DB should most often have used vehicles available while the markets for used vehicles are not very liquid (Monopolkommission 2011). DB may also have an advantage when purchasing new vehicles because it potentially has more buyer power. Additionally, a central source of risk for the operators is the use of the vehicles after the contract because they have a substantially longer economic lifetime than most service contracts.[9] For small operators with only few alternative usages, investments in vehicles should be relatively risky and thus less attractive.

Although it is a priori not clear whether the advantages for used or for new vehicles dominate, we expect

[8] Quality should be broadly understood. It contains factors as such as reliability, tidiness, and other relevant service components.

[9] For instance, rolling stock has a depreciation duration of 15-25 years in commercial law; service contracts last on average about 9 years.

Hypothesis 2. *DB is more likely to win if used vehicles are admitted.*

Moreover, we expect that financial support for vehicles decreases the disadvantages of risk averse and financially constraint operators for investments in new vehicles.

Hypothesis 3. *DB is more likely to win if* no *financial support for new vehicles is offered.*

The contract volume can be divided into its duration, the network's length and the frequency of service. Large contracts are a competitive edge for DB if it is more productive on larger and more complex services. An advantage for DB may also result from the fact that the risk is increasing in the volume of the service and thus the competitors might bid less aggressively. Conversely, a longer contract duration may weaken this advantage as the remaining lifetime of vehicles is shorter then, which reduces the risk.

Hypothesis 4. *DB is more likely to win a contract if the contract volume is large.*

The incumbent of a network should benefit from its experience as it possesses relevant information for successful operations thereon. Moreover, an incumbent has already sunk the (learning) cost that come with the first operation of a network. Thus the incumbent should be able to offer a more attractive contract and so we expect an incumbent to be more likely to win a contract. As DB is mostly the incumbent, we particularly want to test

Hypothesis 5. *DB is more likely to win a contract if it is the incumbent.*

Regarding the number of bidders, a lower number amounts to fewer competitors, suggesting an advantage for DB who can be assumed to virtually always bid in a tender (cf. FAZ 2011). There may, however, be countervailing effects. For example, potential operators may rationally expect to win the awarding primarily if they were excessively optimistic about its profitability. This winner's curse tends to increase in the number of less informed bidders and may therefore cause a decrease in the aggressiveness of bidders. See Hong and Shum (2002) for an analysis of these effects in construction procurement auctions with symmetric bidders. Although it is a priori not clear which effect dominates, we take on

Hypothesis 6. *DB is more likely to win a contract if the number of bidders is low.*

4.2 The number of bidders in competitive awarding procedures

A major challenge in designing awarding procedures is to attract the optimal number of operators who submit bids in auctions and, analogously, participate in negotiations. The number of competing operators (we use the term bidders synonymously here) in an awarding procedure is likely to affect the intensity of competition and thereby efficiency as well as the subsidy level.

Preparing an offer is considered to require substantial effort by the operator. If many awarding procedures take place contemporaneously, organizational capacity constraints may be binding (cf. FAZ 2011), yielding

Hypothesis 7. *The number of bidders is higher if less other awarding procedures take place at the same time.*

The smaller the competitive advantage of DB is, the more other operators should be willing to hand in an offer. Competitive advantages are further discussed in the following subsection. Some of those factors may nevertheless facilitate participation. Although a large contract may cause a competitive edge for DB, a company should be more willing to invest volume independent preparation costs if higher contract volumes and thus potential rewards make these costs negligible. Moreover, the contract duration is likely to positively affect the number of bidders as it also reduces an operator's risk with respect to vehicle investments, hence

Hypothesis 8. *The number of bidders is higher if a) DB has fewer competitive advantages and b) the contract duration is higher.*

4.3 The subsidy level

The subsidy level, measured in Euros per train-km, affects the operator's profits and, equivalently, the public sector's expenses. An agency should aim at a low subsidy level for a given service quality.

An increasing number of bidders in an awarding tends to increase the competitive pressure and is expected to reduce the resulting subsidy. A potentially countervailing effect is the winner's curse described above. Nevertheless we expect

Hypothesis 10. *The resulting subsidy level is lower if the number of bidders is higher.*

With a net contract, the operator obtains the residual claims on the ticket revenues, whereas the agency retains them in a gross contract. Hence the train operator should demand a lower subsidy in case of net contracts. A potentially countervailing effect is that DB is expected to have a competitive edge on net contracts, which may relax competition and thus potentially increase the subsidy. Moreover, the ticket revenues are risky and therefore a smaller operator should demand a risk premium for baring the revenue risk. However, we expect the latter two indirect effects to be smaller than the direct effect of receiving the ticket revenues. Hence

Hypothesis 11. *The resulting subsidy level is lower for net contracts.*

The large operator DB may have a competitive advantage if the contract volume is large, especially if its competitors are risk averse. This suggests that competition and thus the resulting subsidy level is higher for large volumes. A countervailing effect is that railway operations are likely to exhibit economies of scale or density so that the costs per train kilometer decrease as the number of train kilometers increases, hence

Hypothesis 12. *The required subsidy level is lower if the network length and frequency of service increase.*

In some awarding procedures, agencies require new vehicles. This increases the costs as well as the risk after the contract's duration for the train operator compared to the usage of used vehicles. Therefore, the subsidy level is likely to be high if the purchase of new vehicles is required. If financial support for this purchase is offered, the subsidy level should be lower.

Hypothesis 13. *The required subsidy level is lower if a) used vehicles are admitted and b) financial support for new vehicles is offered.*

5 Data

A comprehensive *public* database on the awarded contracts in the German regional passenger railway service is not available (Link and Merkert 2011). To perform an econometric analysis of our hypotheses, we have collected data on the awarding procedures.

We used the Supplement to the Official Journal of the European Union and annual publications of the Deutsche Bahn AG to obtain base information on most of the contracts. Data on the number of bidders, subsidies and financial support were mostly not reported. To obtain these information, we contacted the regional transport agencies and asked them to add details on awarding procedures and on further procedures not collected by us. Out of the 27 active agencies, 23 answered our questionnaire (see Appendix). Additional data, in particular on procurement prices, has been kindly provided by the consultancy Nahverkehrsberatung Südwest.[10]

Furthermore, we added publicly available data on the ownership structure of the operators, the length of the network and electrification (otherwise diesel engines are required). We collected these information from public sources such as the websites of the BAG-SPNV and the German Federal Statistic Office (Statistisches Bundesamt).[11]

Description of the variables. The variable *DB wins* is an indicator equal to 1 if the winning operator is owned by DB, and 0 otherwise. We define an operator to be owned by DB if the Deutsche Bahn AG directly or indirectly holds at least 25% of its equity. *DB incumbent* is an indicator equal to 1 whenever a company which is at the time of the awarding procedure owned by DB has operated trains on the network before. *Competitive awarding* equals 1 if the contract was awarded competitively and 0 otherwise. *Auction* equals 1 if the agency awarded the contract via an auction and 0 if it chose a competitive negotiation. *Auction* is defined for competitive awarding procedures only. We define auctions as open tenders in which operators formally submit bids, and negotiations the less formal procedures in which the agency enters negotiations with potentially more than one operator. We have asked the agencies to make the distinction between open tenders (auctions), negotiations and non-competitive awarding in the questionnaire. *Number of bidders* specifies the number of operators who were independently active in a competitive awarding.

[10] Some of this data has also been used by Lalive and Schmutzler (2011).

[11] BAG-SPNV is the umbrella organisation of 26 of the 27 active procurement agencies.

Different distributions of the ticket revenues are common. In so-called net contracts, the operator obtains the revenues, whereas in gross contracts the agency receives them. Stated differently, the operator (the agency) is the residual claimant of the earnings in net contracts (gross contracts) and thus bears the revenue risk. The operator has ceteris paribus a larger incentive to maximize the ticket revenues in net contracts. To maintain these incentives but reduce the risk, there also exist gross contracts with additional schemes to incentivize a high service quality. *Net contract* is 1 if the operator is the residual claimant of the revenues from ticket sales, and 0 in case of gross or gross incentive contracts. Furthermore, the procurement contracts often allow for passing on cost increases to the agency. We do not have sufficient variation in the data to include cost risks and therefore solely use net contracts as a proxy for profit risks.

Used verhicles admitted has the value 1 if the operator is allowed to employ used rolling stock (traction units and wagons) to operate the service. *Rolling stock financial support* is 1 if the agency offers support for the financing of new rolling stock. *Duration* contains the number of years the contract requires the operator to carry out the service. *Network length* is the length of the network in kilometers. $Train-km$ is the number of million kilometers which have to be operated per year. $Frequency$ is the ratio of train and network kilometers. $Electrified$ takes on the value 1 if at least 80 percent of the network are electrified. *Simultaneous awardings* counts the number of other competitive awarding procedures which were announced or took place in Germany within the year before the current awarding took place. $1996-2003$ is an indicator which is 1 if the contract is awarded in the years from *1996-2003*; *2004-2007* and *2008-2011* are defined analogously. *Awarding year* contains the year in which the contract was awarded.

Subsidy per train $-$ *km* contains the Euros per train kilometer which the agency pays to the operator in the first year of operation. This information is particularly difficult to obtain as it is seldom public; moreover, the majority of agencies have been hesitant in reporting it. For this measure we heavily rely on the consultancy Nahverkehrsberatung Südwest. Where possible, we have double checked their figures with our own data.

Table 2: Descriptive statistics

	mean	sd	min	max	count
DB wins	0.35	0.48	0.00	1.00	268
DB incumbent	0.81	0.39	0.00	1.00	208
Number of bidders	3.59	1.93	1.00	11.00	169
Subsidy (EUR per train-km)	8.70	4.66	0.31	32.12	112
Auction	0.55	0.50	0.00	1.00	182
Competitive awarding	0.68	0.47	0.00	1.00	268
Used vehicles	0.62	0.49	0.00	1.00	186
Vehicle support	0.34	0.47	0.00	1.00	178
Net contract	0.60	0.49	0.00	1.00	253
Duration	9.40	4.48	1.00	22.00	268
Train-km (Mio. km per year)	3.25	8.12	0.00	98.10	267
Network length (km/100)	1.51	1.41	0.07	9.09	234
Frequency (train-km/network-km)	1.89	5.75	0.00	85.39	233
Electrified	0.36	0.48	0.00	1.00	239
Simultaneous awardings	26.26	10.82	0.00	47.00	268
Years 1995-2003	0.38	0.49	0.00	1.00	268
Years 2004-2007	0.32	0.47	0.00	1.00	268
Years 2008-2011	0.30	0.46	0.00	1.00	268

6 Results

6.1 Determinants of the winner of competitive awarding

To study the determinants of a success of DB in competitive awarding, we first perform three OLS regressions of the indicator $DB\,wins$ on general awarding characteristics, design options and the number of bidders. In order to account for the potential correlation of the number of bidders with unobserved characteristics that potentially influence the success of DB, we instrument the number of bidders. As instruments, we use the past competitive activity in the state, the number of simultaneous awarding procedures and the awarding year. These factors arguably influence the tendency of operators to participate in awarding procedures rather than the actual awarding, given participation. Using the overidentifying restrictions in a Hausman test indicates that the instruments are valid. In any case, we compute robust and agency clustered standard errors. For all regressions, we have centered explanatory variables other than indicators.

Columns (3), (4) and (5) of Table 3 all include the number of bidders and yield qualitatively similar results. Without the number of bidders, net contracts have a significant positive correlation with DB. This supports Hypothesis 1. When controlling for the number of bidders, however, the significance vanishes as net contracts are – reasonably – correlated with the

number of bidders. Hence the the effect of net contracts appears to be rather indirect through the number of bidders.

Allowing for used vehicles is significantly (almost so in the IV version) and positively correlated with DB wins across all specifications, yielding

Result to Hypothesis 2. *DB is more likely to win a contract if used vehicles are admitted.*

This result suggests that DB has a competitive edge because it is better equipped than its competitors with used rolling stock. No significant correlation can be established between new rolling stock financing and that DB wins. The coefficients on network length and contract duration are positive and significant, yielding

Result to Hypothesis 4. *DB is more likely to win contracts with a long network and duration.*

This result suggests that DB is more capable, or at least more keen to win large contracts. DB is significantly more likely to win electrified networks which, by itself, is not straightforward. A potential reason could be that diesel lines are more remote and less attractive such that DB is less keen to win these.

Throughout all specifications there is a positive and significant correlation of DB wins and DB incumbent, yielding

Result to Hypothesis 5. *DB is more likely to win a contract if it is the incumbent.*[12]

The reason for this result may be due to sunk costs which reduce the incumbent's total costs of another operation in comparison to newcomers. However, discrimination against new operators may also occur particularly in these awardings. A further possibility is that DB has intentionally not operated unattractive routes before and consequently does also not bid for them anymore.

The number of bidders is significantly and negatively correlated with DB. This correlation is even stronger when instrumenting for the number of bidders. According to the linear probability specification, one more bidder is associated with a decrease in the probability that DB wins of 5% (11% in the instrument specification). Hence

Result to Hypothesis 6. *DB is more likely to win a contract if the number of bidders is low.*

[12]Testing for incumbency advantages of other firms is complicated by the fact that there are not many of such cases in the data.

	DB wins				
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	IV-OLS	Probit
DB incumbent	0.21**	0.28**	0.33***	0.38***	1.23***
	(2.65)	(2.71)	(3.02)	(3.52)	(2.92)
Electrified	0.14*	0.29**	0.26**	0.25*	0.86***
	(1.92)	(2.86)	(2.38)	(1.99)	(2.63)
Frequency (train-km/network-km)	0.04***	-0.00	-0.01	-0.01	0.01
	(3.13)	(-0.18)	(-0.23)	(-0.32)	(0.12)
Network length (km/100)	0.10***	0.06***	0.07***	0.07***	0.24***
	(5.87)	(3.40)	(3.30)	(2.92)	(3.13)
Duration		0.02*	0.02**	0.01**	0.06**
		(1.84)	(2.25)	(2.53)	(2.20)
Auction		-0.05	-0.05	-0.02	-0.24
		(-0.60)	(-0.63)	(-0.17)	(-0.80)
Used vehicles		0.24***	0.20**	0.14	0.70**
		(3.25)	(2.73)	(1.50)	(2.50)
Vehicle support		-0.10	-0.10	-0.06	-0.30
		(-1.11)	(-1.20)	(-0.67)	(-0.98)
Net contract		0.18**	0.12	0.01	0.42
		(2.53)	(1.53)	(0.04)	(1.64)
Number of bidders			-0.05**	-0.11**	-0.17**
			(-2.49)	(-2.73)	(-2.30)
Constant	-0.09	-0.36**	-0.19	0.01	-2.45***
	(-1.53)	(-2.22)	(-1.00)	(0.05)	(-3.01)
Agency dummies	No	No	No	Yes	No
Observations	178	128	127	127	127
Adjusted R^2	0.151	0.195	0.217	0.151	

Robust, agency-adjusted standard errors; in parantheses: t-values; * p < 0.1, ** p < 0.05, *** p < 0.01
Dependent variable is 1, if DB wins the awarding, otherwise 0. Probit output: Coefficients.
Instruments: simultaneous awardings, regional competitiveness, awarding year.
F-test for joint significance: 3.33 (p<.043).

Table 3: Regression on DB wins

6.2 Determinants of the number of bidders in competitive awardings

To explain the number of independent bidders in competitive tenders, we employ two econometric approaches. We regress the number of bidders on various potentially relevant characteristics using OLS. Moreover, we use a Poisson specification to account for the fact that we are dealing with count data.

The regression results are in Table 4. The first column contains the coefficient of an OLS regression on general characteristics such as the awarding year and network characteristics. The explanatory power of this regression is rather low. It is more revealing to look at column (2) where design parameters such as the contract duration are included, and at column (3) where also agency fixed effects are included. The Poisson counterparts deliver qualitatively similar

results.

The coefficient on *simultaneous awardings* is clearly negative, but it is mostly not significant at common levels, so there is no strong evidence that the number of bidders is lower when there are more other awarding procedures.[13] We refrain from drawing conclusions here.

	Bidders				
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	Poisson	Poisson
DB incumbent	0.87*	0.68	0.59	0.24*	0.20
	(2.08)	(1.50)	(1.20)	(1.71)	(1.36)
Electrified	0.14	-0.41	-0.10	-0.12	-0.03
	(0.49)	(-1.22)	(-0.23)	(-1.32)	(-0.32)
Frequency (train-km/network-km)	0.07	0.01	-0.25	0.00	-0.06
	(0.52)	(0.08)	(-0.98)	(0.04)	(-1.12)
Network length (km/100)	-0.04	0.10	0.11	0.02	0.03
	(-0.29)	(0.75)	(0.95)	(0.60)	(0.90)
Simultaneous awardings	-0.06**	-0.03	-0.04	-0.01	-0.01
	(-2.27)	(-1.02)	(-0.71)	(-1.34)	(-1.35)
Duration		0.05	0.07	0.02*	0.02***
		(1.61)	(1.44)	(1.90)	(2.68)
Auction		0.09	0.88**	0.05	0.27**
		(0.29)	(2.16)	(0.62)	(2.29)
Used vehicles		-0.55**	0.01	-0.13	0.01
		(-2.20)	(0.02)	(-1.57)	(0.07)
Vehicle support		-0.15	-0.26	-0.01	-0.06
		(-0.27)	(-0.42)	(-0.07)	(-0.41)
Net contract		-1.49***	-0.50	-0.41***	-0.17
		(-3.93)	(-0.89)	(-4.39)	(-0.71)
Awarding year		-0.05	-0.12	-0.01	-0.04**
		(-0.45)	(-0.91)	(-0.32)	(-2.50)
Constant	4.33***	99.37	235.56	17.78	74.86**
	(5.20)	(0.47)	(0.93)	(0.35)	(2.52)
Agency dummies	No	No	Yes	No	Yes
Observations	154	127	127	127	127
Adjusted R^2	0.101	0.142	0.285		

Robust, agency-adjusted standard errors; in parantheses: t-values; * p < 0.1, ** p < 0.05, *** p < 0.01
Dependent variable is the number of bidder in a competitive awarding.
Agency dummies are highly correlated with net contract and explain percent of the latter's variance.
F-Test for joint significance of agency dummies in OLS has value 3.9 (p<.001).

Table 4: Regression on the number of bidders

The coefficient on net contract is significantly negative in specifications (2) and (4). This is reasonable because net contracts are potentially a competitive edge for DB, as argued before. The insignificance when agency indicators are included is not surprising because using net or

[13] A confounding factor is of course the number of active operators. We can only control for these by allowing for a time trend.

gross contracts is highly agency specific. When including agency indicators, the net effect can no more be identified with the relatively small variation in the data across agencies.

Although there is some indication that there are less bidders when used vehicles are admitted, we refrain from drawing conclusions on this. Vehicles support has no significant effects. In three out of four specifications, however, the coefficient on contract duration is significantly positive (and in the 4th almost). We summarize in

Result to Hypothesis 8. *The number of bidders is lower when net contracts are employed, but higher when the contracts are longer.*

As argued before, longer contracts potentially favor newcomers in that investments in information are more worthwhile and the risk of purchasing rolling stock lower.

Controlling for agency fixed effects, there appears to be a negative time trend in the number of bidders. This is in line with industry insiders arguing that the number of bidders has decreased over time (Holzhey et al., 2011).

6.3 Determinants of the subsidy level in competitive awarding

	Subsidy				
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	IV-OLS
DB incumbent	-2.33	-2.14	-2.12	-2.26	-2.36
	(-1.37)	(-1.11)	(-1.39)	(-1.51)	(-1.57)
Electrified	-0.72	-0.53	-1.24	-1.28	-1.30
	(-1.38)	(-0.78)	(-1.22)	(-1.31)	(-1.36)
Frequency (train-km/network-km)	-0.05	-0.49	-0.53	-0.52	-0.51
	(-0.29)	(-0.73)	(-0.92)	(-0.92)	(-0.92)
Network length (km/100)	0.13	-0.07	0.01	0.06	0.10
	(0.71)	(-0.29)	(0.05)	(0.33)	(0.44)
Number of bidders		0.01		-0.39*	-0.66
		(0.07)		(-2.12)	(-1.54)
Duration			0.08	0.09	0.09
			(0.53)	(0.54)	(0.54)
Auction			1.14	1.09	1.06
			(1.17)	(1.02)	(0.90)
Used vehicles			1.41	0.94	0.61
			(1.12)	(0.74)	(0.50)
Vehicle support			0.72	0.49	0.33
			(0.71)	(0.50)	(0.32)
Net contract			-2.56***	-3.46***	-4.10***
			(-3.73)	(-4.56)	(-3.30)
Awarding year			-0.02	-0.09	-0.13
			(-0.13)	(-0.60)	(-0.87)
Constant	10.24***	10.96***	46.38	183.72	281.25
	(5.45)	(4.58)	(0.16)	(0.64)	(0.91)
Observations	84	73	57	57	57
Adjusted R^2	0.028	0.008	0.179	0.192	0.176

Robust, agency-adjusted standard errors; in parantheses: t-values; * p < 0.1, ** p < 0.05, *** p < 0.01
Dependent variable is the subsidy level in the first year of operation.

Table 5: Regression on the subsidy level (€ per train-kilometer)

We regress the subsidy level on potentially relevant characteristics using OLS and compute robust standard errors. Analogous to the analysis of the winner in Subsection 6.1, we additionally instrument the number of bidders (Column 5), but find no qualitative differences. A caveat applies with respect to the subsidy level as only relatively few observations are complete and thus useful for the regression analysis.

In Columns 4 and 5, the coefficient on the number of bidders is negative, but weakly significant only in Column 4. Hence there is only weak indicative support for the hypothesis that more bidders reduce the subsidy level. We thus do not conclude on Hypothesis 10.

As expected, net contracts are associated with lower subsidies, and that by 2.5 to about 4€ per train-km, yielding

Result to Hypothesis 11. *The subsidy level is lower for net contracts.*

This finding is not surprising at all: When an operator receives more revenues, he should be willing to operate for less subsidies. Note, however, that Lalive and Schmutzler (2011) do not find such an effect.[14]

No significant correlations can be found between the subsidy level and contract volume measures, used vehicle admittance and financial support. Effects may simply not show up, however, as the sample is quite small. Hence we do not conclude on Hypotheses 12 and 13.

6.4 Differences between competitive and direct awarding

We have information on most awarding procedures which took place until the mid of 2011. Unfortunately, detailed information, in particular on subsidies, is only available for a subset of these. Table 6 contains a mean comparison of 92 direct and 182 competitive awarding procedures. Observe that there is no significant difference in the fraction of direct and competitive awardings won by DB. This suggests that direct awarding does not favor DB. Note, however, that of the directly awarded train kilometers, about 90% were given to DB; a large fraction of these were awarded with the *large DB-contracts* of 2003 and 2004 (own calculations, not in the table). This explains that the average annual volume of contracts which were directly awarded is with about 6 million train kilometers significantly larger than the average volume of competitive contracts. There are on average no significant differences in contract duration and rolling stock financial support. Used vehicles are more often admitted in non-competitive awardings, which notably also include contract extensions. Moreover, observe that net contracts are significantly more common in non-competitive awarding. A potential reason is that revenue information is more critical for net contracts, making them less attractive for competitive awarding.

Comparing the mean subsidy per train-km in Table 6, we observe that the level in case of competitive tenders is significantly lower. Note, however, that we do not control for confounding factors here. Nevertheless, this observation is broadly in line with the results of other authors.

Differences between direct awarding to DB and competitive awarding with a focus on the evolution of the traffic frequency have been studied studied by Lalive and Schmutzler (2008b, 2011) for the years 1994 to 2004. The traffic frequency is defined as the ratio of train kilometers on a line to the length of the line itself. The unit of observation is a line and *not* an awarding as both in Table 1 and our following analysis. An awarding typically includes several lines.[15] Lalive and Schmutzler (2011) consider 551 lines in entire Germany.[16] They find that the frequency

[14] See their Table 5.

[15] Dividing the 551 lines by the number of awardings we have in our database until 2004, we have about 4 lines per awarding.

[16] The 2008 paper covered only the development of the frequency for the case of Baden-Württemberg for the same time period. Its major results are in line with those of the 2011 paper.

of service on non-competitively served lines grew less between 1994 and 2004 than on lines procured competitively. Moreover, for a subset of the lines with available data, the subsidy level per train kilometer is found to be about 25% lower on competitive lines.[17]

An interesting point is the interpretation of these findings as the directly awarded lines until 2004 consist primarily of lines awarded in the large DB-contracts. Hence the outcomes of several competitive tenders with relatively small volumes are mainly compared to few very large direct awardings. Finding lower prices on competitively procured lines is consistent with a dominant operator facing pressure by a competitive fringe with limited capacity. This can yield low prices for the slice of the market covered by the fringe and monopoly prices on the remainder.[18] In line with this reasoning, Holzhey et al. (2011) argue that the agencies had no serious alternative to the prices asked by DB.[19] The results of Lalive and Schmutzler (2011) indicate that there are significant (at least first round) gains in competitive tenders, albeit more complete evidence with also more recent data on which is the better procurement mechanism is still desirable. This is left for future research.

	Non-competitive	N	Competitive	N	Difference	p-value
DB wins	0.36	86	0.34	182	0.02	0.75
DB incumbent	0.71	41	0.84	167	-0.13	0.05
Subsidy per train-km	10.76	27	8.04	85	2.72	0.01
Used vehicles admitted	0.82	39	0.56	147	0.26	0.00
Net contract	0.80	74	0.53	179	0.27	0.00
Cost pass through	0.90	40	0.90	135	0.00	0.95
Rolling stock financial support	0.39	38	0.32	140	0.07	0.40
Duration	8.85	86	9.65	182	-0.81	0.17
Train-km	5.81	85	2.06	182	3.74	0.00
Network length	1.50	63	1.51	171	-0.01	0.98
Simultaneous awardings	23.40	86	27.62	182	-4.23	0.00
Regional competitiveness	0.27	86	0.38	182	-0.11	0.00
Years 1995-2003	0.45	86	0.35	182	0.11	0.09
Years 2004-2007	0.33	86	0.32	182	0.01	0.91
Years 2008-2011	0.22	86	0.34	182	-0.11	0.06
Observations	268					

Table 6: Mean comparison of direct and competitive awarding

[17] One should note, however, that the authors mentioned here use price data of the Nahverkehrsberatung Südwest which we also use in addition to data collected ourselves.

[18] Lalive and Schmutzler (2011) test for a price and train kilometer difference if DB wins a competitive procurement but find none. However, they do not document whether negotiations in their classification show differences respective to this (cf. Table 6 in Lalive and Schmutzler (2011), the basis effect "incumbent" is missing). Potentially, direct awardings to other operators result due to market power in similar prices as competitive awardings.

[19] Holzhey et al. (2009) find a price difference broadly in line with Lalive and Schmutzler (2011); they also use at least partly the same subsidy database. Cf. page 16 in the former.

7 Concluding remarks

In this paper we have discussed several hypotheses regarding competitive awarding of short haul railway passenger services in Germany and have tested these using a newly collected data set. In line with Beck (2011), we have confirmed that revenue risks are associated with less bidders and, in line with Lalive and Schmutzler (2008a), that DB is more likely to win long networks. Also, we find that DB is more likely to win electrified networks. A higher contract duration, though making DB more likely to win, also tends to attract more bidders. This is reasonable in that long contracts are potentially more attractive than short contracts for all operators because the lifetime of vehicles is comparatively long, so operator's can better plan their utilization. A potential takeaway for policy is that also new operators seem to favor long contracts, although they are not particularly successful in winning these. We also find that DB has a substantial incumbency advantage for winning a contract and is also more likely to win when used vehicles are admitted, which indicates a potential barrier to entry for new competitors. Our analysis shows that more bidders are associated with a lower likelihood that DB wins a contract, suggesting that facilitating participation in awarding procedures increases competition.

Although our data is rich in terms of the number of awarding procedures covered and the number of characteristics observed, when compared to data used in existing studies, it nevertheless has severe shortcomings. Important information, such as the subsidy level, is still not available for the majority of the competitive awarding procedures. Better data is thus essential for future research.

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Appendix: Questionnaire

Vergabebogen

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Erläuterungen zum Ausfüllen finden sich auf dem Beiblatt. Bitte senden Sie den Bogen an o.g. Adresse zurück.

Aufgabenträger (AT):

1. Vergabe**:**

   a. Losnummer (ggf.): b. TED-Nummer*:*

2. Datumsangaben
   a. Bekanntmachung Vergabe: _____
   b. Vergabe erfolgte: _____
   c. Betriebsbeginn: _____
   d. Laufzeit in Jahren: _____
3. Vergabecharakteristika
   a. Verfahrensart: _____
   b. Anzahl bietende / teilnehmende EVU: _____
   c. Mio. Zugkilometer pro Jahr: _____
   d. Altanbieter: _____
4. Vergabeergebnis
   a. Gewinner: _____
   b. Bestellerentgelt in Euro pro Zugkm: _____
5. Vertragscharakteristika
   a. Nettovertrag ☐ Bruttoanreizvertrag ☐ Bruttovertrag ☐
      Anteil Netto (in Prozent): _____%
   b. Kostensteigerungen werden zumindest tlw. durch AT getragen Ja ☐ Nein ☐
      Anteil Kostensteigerungen vom AT getragen: _____%
   c. Gebrauchtfahrzeuge zugelassen: Ja ☐ Nein ☐
   d. Unterstützung bei Fahrzeugfinanzierung durch AT Ja ☐ Nein ☐
      Wenn ja, geldwerte Unterstützung von ca. _____€;
      Wenn ja, zutrefffendes ankreuzen:
      I) Fahrzeugübernahmeoption nach Vertragsende (WEG): Ja ☐ Nein ☐
      II) Fahrzeuge werden von AT gestellt: Ja ☐ Nein ☐
      III) Direkte Fahrzeugförderung durch AT / Land Ja ☐ Nein ☐
      IV) Sonstiges: _____
   e. Durchschnittliche Beförderungskapazität pro Zug: _____Personen
6. Betriebsmerkmale
   a. Mio. Personenkilometer pro Jahr bei diesem Verkehrsauftrag: _____
   b. Durchschnittliche Auslastung eines typischen Zuges: _____%