Exploring the Effects of Competition for Railway Markets

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Abstract: This paper studies the effects of introducing competition for local passenger railway markets in the German state of Baden-Württemberg. We compare the evolution of the frequency of service on lines that were exposed to competition for the market with lines procured by direct negotiations with the incumbent. Our results suggest that the competitively procured lines enjoyed a stronger growth of the frequency of service than those that were not procured competitively, even after controlling for various line characteristics that might have had an independent influence on the frequency of service. Our results further suggest that the effects of competition may depend strongly on the operator.

Keywords: Competition for the market, liberalization, passenger railways, procurement auctions

JEL Classification: D43,D44,R48

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1   Introduction

As a consequence of the railway reforms in the nineteen nineties, the former state monopolies are facing increasing competition in many European countries. The proponents of the reforms argue that this development will not only lead to decreasing transfer payments to railway operators, but also to better railway services.[1] However, this opinion is not undisputed. First, there are serious arguments that cast doubt on the hope that the potential efficiency gains from liberalisation in the railway industry are similar to those in other sectors, most notably telecommunications.[2] Second, it is not obvious that the institutional details in the liberalized railway industry have been chosen in such a fashion that potential efficiency gains are realized.[3] From a-priori considerations, it is impossible to come to a definite conclusion regarding the pros and cons of liberalization as such, let alone the particular institutions chosen in the different European countries.

The empirical evaluation of the railway reforms is still in its infancy. A small number of contributions deals with the efficiency effects of various reforms in an international context on a highly aggregate level (Cantos et al. 1999, Friebel et al. 2003). Friebel et al. identify positive efficiency effects of deregulation. Several contributions analyze the outcomes of the U.K. reform (Cowie 2002, Pollitt and Smith 2001), coming to more positive conclusions than the political debate in the U.K. would suggest. Our contribution concentrates on a concrete measure, the German *Regionalisierungsgesetz*, a law that was passed in 1993.[4] This measure led to a massive change in the procurement of regional passenger transportation. Even though transfer payments from the central government are still used to finance

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[1]Unsurprisingly, a particularly optimistic perspective on the potential efficiency gains from competition comes from a report commissioned by *MehrBahnen,* an organisation of competitors of the German state enterprise *Deutsche Bahn* (pspc 2004). The report estimates the potential reduction in subsidies from relying on competitive mechanisms for procuring regional passenger services at 18-38%, depending on the type of service.

[2]For instance, there is no reason to expect similar technological improvements as in the telecoms sector, as the railroad technology is comparatively mature. Also, as argued by Pittman (2005), compared to other sectors, the cost share of the potentially competitive sector is smaller for railways.

[3]For instance, there is no consensus as to the right extent of vertical separation. Also, it is not obvious how access prices should best be regulated, for instance in view of the implied investment incentives for network owners and operators. In the case of the British reform, both issues were hotly debated (see, e.g. Bühler et al. 2004).

[4]Officially, the law is known as *Gesetz zur Regionalisierung des öffentlichen Personennahverkehrs.* It was passed on December 27, 1993 as Article 4 of the *Eisenbahnneuordnungsgesetz,* which contains most of the legal foundations for the German railway reform.

short-distance trains and other forms of public transport, the role of the central state for procurement is indirect. Each year, it distributes a substantial amount of money (around five billion Euro in each year between 1997 and 2004) to the 16 states (*Länder*) who are now responsible for the procurement of regional passenger transport, and railway services in particular.[5] The states, in turn, delegated this task to newly founded agencies. These agencies are now allowed to use competitive franchising to procure the services, which typically means that firms bid in transfers demanded to carry out the required service obligations, with the lowest bidder having to supply the service in return for the demanded transfer. Importantly, however, agencies are not obliged to use such competitive procedures. On 20-25% of the passenger railway lines in Germany, a substantial part of local passenger services is now procured in a (more or less) competitive fashion. On the remaining lines all services are still provided by the incumbent without any competition for the market. Typically, the service provider in these cases is *DB Regio*, a subsidiary of *Deutsche Bahn AG*, the successor of the former state monopolist; in much rarer cases, some other company carries out the service without having obtained the franchise in a competitive fashion.[6]

While DB Regio is still the dominant operator ten years after the reforms were introduced, its competitors, the *NE-operators*,[7] have expanded their market share in Germany from about 3% at the beginning of the reform to 13.2% in 2004 (DB AG 2005).[8] Moreover, in cases where competitive bidding is applied, the competitors are successful at least as often as DB Regio (Lalive and Schmutzler 2006), suggesting that in the medium term this operator's dominance may well belong to the past.[9]

The paper explores whether competition for the market has had a positive effect on the performance of passenger railways. We concentrate on the state of Baden-

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[5]The development of the yearly transfer payments is reported in Deutsche Bahn (2003). Note, however, that only about 80% of the payments are devoted exclusively to rail services as some of the money is used for other activities such as infrastructure investments and for other modes of transport..

[6]As will be laid out in Section 2, a considerable number of small operators were already active before the railway reform.

[7]"NE" refers to "nicht bundeseigen", that is, not belonging to the Federal Republic of Germany. The term contains both privately owned firms and firms that belong to the public sector (e.g., firms that are owned by local authorities).

[8]This market share is expressed in terms of the services supplied (train kilometers). In terms of patronage, the competitors' market share is still below 6%.

[9]It should be noted, however, that there is a recent tendency for agencies to write long-term contracts with *DB Regio* which put limits on the extent to which competitive bidding will be used in the future. For instance, in Baden-Württemberg such a contract was signed in 2003 (Stuttgarter Nachrichten 2003).

Württemberg, one of the largest German states, where the fraction of railway lines that have been exposed to competition is well above average. Apart from the fact that this restriction in the scope of the analysis simplifies the task of data collection, focusing on one state has the additional advantage of reducing within-sample heterogeneity.

Economic theory provides two reasons why it should be possible with competitive bidding to achieve any desired service level with lower transfer payments. First, competition puts pressure on firms to enter low bids; second, it helps to select the most efficient supplier. The partial introduction of competition in Germany greatly simplifies identifying the effects of competition, because we can compare the evolution of the performance on the competitive and the non-competitive segment of the market. However, the data situation is far from perfect. Ideally, one would like to use a variable as a performance measure that takes both the costs and benefits of providing railway service into account, such as transfer payments per train kilometer or preferably per passenger kilometer. Unfortunately, it is impossible to obtain data on the evolution of transfer payments at the level of individual lines. Instead, our analysis attempts to clarify whether the development of the service level for the competitively procured lines has been more favorable than for the remaining lines, where the service level is defined as the frequency of service on the railway line under consideration.[10]

Using self-collected data from the years 1994 and 2004, we show that the frequency of service on those lines that were procured competitively developed more favorably than on those that were not. There also appears to be some evidence for a relation between the evolution of the frequency of service and the operator of the line. On the one hand, NE-operated non-competitive lines tend to grow more rapidly than the corresponding lines operated by *DB Regio*. On the other hand, while the additional effect of competition is strong and significant for *DB Regio*, it is mixed for the NE-operators. For the largest NE-operator, the Albtalbahn-Verkehrsgesellschaft (AVG) near Karlsruhe, the competition effect is very strong, whereas the remaining lines with NE-operators do not develop much differently than their counterparts that did not face competition.

Obviously, from the fact that we identify a positive relation between competition and growth of the service level one should not jump to the conclusion that competition is the cause of these effects. Clearly, our analysis does not preclude the possibility that the faster growth on the competitively procured lines arises merely

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[10] See Section 3 for a discussion of this definition.

because agencies systematically spent more money on them than on the remaining lines. Based on our explorative analysis, it is impossible to rule out this possibility. However, an alternative interpretation is that agencies demand more of the potential contractors when they use competitive bidding than when they face a monopolist, because they are confident that they will get these services for a relatively low level of transfer payments. Our analysis does not allow us to fully discriminate between the two alternatives, but at least the notion that agencies expect to pay less when they face competition is consistent with the experience from other countries.[11] It also fits well with pieces of information that leak out from the industry.[12]

Another obvious argument against our conclusion that competition has beneficial effects relates to reverse causality. In principle, agencies may be inclined to procure those lines competitively that have greater growth potential than others.[13] Though we cannot fully rule out this possibility, we try to control for influence factors other than the mode of procurement which might relate to the growth potential of the line. Most importantly, we consider population growth as such a factor. Even though population growth has a modest effect on the change in the frequency of service, including the variable does not lead to a substantial change of our predicted competition effect. This at least provides some support for the notion that the competition effect is not a pure selection effect.

Finally, even leaving aside the issue of the causal relation between competition and service growth, one might debate whether the changes are positive from a welfare point of view. Most importantly, theoretical considerations would suggest that the increased frequency of service associated with privatization and competition might come at the cost of lower non-contractible quality. In the concluding section, we argue that such well-taken concerns are presumably relatively unimportant in the concrete example.

The remainder of the paper is organized as follows. In Section 2, we shall sketch some institutional background and develop our hypotheses. Section 3 describes the

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[11]Pollitt and Smith (2001) and Alexandersson and Hultén (2005) both argue that franchising led to lower subsidies in the U.K. and Sweden, respectively.

[12]For instance, according to BDI-Drucksache (2006), competitive procurement of the *Ostküsten-netz* in the state of Mecklenburg-Vorpommern in 2005 was associated with a reduction in transfer payments from around 30 mio. Euro to 23 mio. Euro.

[13]Using the telecommunications industry as an example, Duso and Röller (2003) argue that treating policy as exogenous may lead to estimates of competition effects that are biased upwards. Policy endogenity is addressed more generally by Krozner and Strahan (1999) and Besley and Case (2000). Though there is a possibility of endogeneity in our context, the problem is mitigated by the fact that we control for the agencies who take the decisions, so that different political ideologies are unlikely to bias the results.

methods and the data set. In Section 4, we present our econometric results. Section 5 concludes and discusses the approach in more detail.

2 Background and Hypotheses

2.1 Institutional Background

As in most other European countries, the railways in post-war Germany were essentially run by state monopolies until the early nineteen nineties. In West Germany, *Deutsche Bundesbahn* owned most of the infrastructure and, at the same time, was the dominant operator for passenger and freight services. In addition, there were several minor railroad companies (*NE-Bahnen*) that were typically also vertically integrated and carried out freight and/or passenger transportation on small networks. In East Germany, *Deutsche Reichsbahn* was the integrated operator of the railway system.

Major reforms of the railway system were introduced in Germany in the nineteen nineties. These reforms were induced by the EU-directive 91/440, but there was also some internal pressure to introduce changes to the system. First, after reunification, there was the obvious issue of integrating the East and West German railways. Second, the cumulated debt of the two state railways was immense, amounting to 67 bio. Deutschmarks in 1993 (Greffrath and Lingenthal 1994).

On January 1, 1994, the railway reform became effective. Apart from creating *Deutsche Bahn AG* as a successor of *Deutsche Bundesbahn* and *Deutsche Reichsbahn*, the reform had several elements that were familiar from other countries. First, though *Deutsche Bahn AG* is generally regarded as a vertically integrated company, distinct sub-organisations were introduced at the upstream level (*DB Netz* for the network and *DB Station & Service* for the stations) and the downstream level (*DB Regio* for regional passenger transportation, *DB Reise und Touristik* for long-distance passenger services and *DB Cargo* for freight). Thus, at least a move into the direction of vertical separation was made.[14] Second, even though the infrastructure is still mostly operated by the former state monopolist, some degree of competition was introduced on the downstream sector. Infrastructure owners, in particular *DB Netz,* are required to allow freight operators and long-distance passenger operators

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[14]In 1999, this separation was taken one step further. Deutsche Bahn AG then became a holding company, consisting of five corporations.

access onto their network.[15] With respect to local passenger services, an entirely different avenue was pursued. Essentially, the reforms led to the introduction of *competition for the market.*[16]

More specifically, as a consequence of the railway reform, the *Länder* have created agencies whose task it is to procure local passenger services. In Baden-Württemberg, the most important agency is the *Nahverkehrsgesellschaft Baden-Württemberg* (NVBW); in addition, the *Verkehrsverbund Rhein-Neckar* (VRN) and the *Verkehrs- und Tarifverbund Raum Stuttgart* (VVS) are in charge of the services in the agglomerations of Heidelberg/Mannheim and Stuttgart, respectively.

These agencies have considerable freedom in the way that they procure services. At one extreme, they can still negotiate directly with the incumbent supplier, without contacting any potential competitors. At the other extreme, they can resort to a formal tender. The extent to which this possibility is used varies considerably across agencies and so do the details of the procedure. In the simplest case, the agency specifies detailed requirements about the level of service quality that it expects. The specifications include the frequency of service, the rolling stock, the prices charged to customers, etc.[17] The contractors' bids are the subsidy levels required to carry out the expected services.[18] The successful bidder receives his required transfer and obtains the franchise for a period of typically 5-10 years. He then becomes the residual claimant for the operating profits of the line.[19]

Differences in contractors' bids reflect both differences in their relative efficiencies and in the quality of the estimations of the value of the franchise, which is driven

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[15]In practice, access is negligible for long-distance passenger trains, but substantial for freight trains.

[16]Competition for the passenger market also plays a role in Sweden and the U.K. and to a much lesser extent in the Netherlands.

[17]In Germany, regional public transport organisations (*Verkehrsverbünde*) coordinate timetables, prices etc. on a substantial part of the network. In some cases, but my no means always, these organisations are identical with the agencies that procure services; often they are entirely separate institutions. Either way, the freedom of railway operators to set prices is limited by the existence of the public transport organisations.

[18]In typical textbook treatments of competition for the market (Viscusi et al. 2000), the procedure is slightly different. Contractors do not bid the required subsidy. Instead, they bid the price they want to charge to consumers and the lowest bid wins (Demsetz 1968).

[19]This description corresponds to so-called *net contracts.* Alternatively, the agencies sometimes use *gross contracts* where the agencies receive the revenues, but the firms are residual claimants of cost savings. There are also cases where the specifications of the auction are less detailed, leaving some scope for the contractors to compete in other dimensions than the required subsidies. As the exact weighting of the different dimensions is typically left unspecified, the allocation mechanism is closer to a "beauty contest" than to multi-dimensional auction in the sense of Che (1993) and Branco (1997).

for instance by the expected number of passengers. Thus, the auction has a private-value component as well as a common-value component. For this reason, it is not necessarily clear that the successful bid will come from the most efficient firm. The winner may simply have overestimated the potential gains from the market. To our knowledge, there is only one obvious case of competitive bidding in the German railway market where this kind of "winner's curse" phenomenon played an important role: The winner of an auction for the line Hamburg-Flensburg in Schleswig-Holstein was the newly founded *FlexVerkehrs AG* that went bankrupt within a year after taking up the service in 2002 (derFahrgast 2003).[20]

As a result of the introduction of competition for the market, the market share of DB Regio's competitors has grown substantially. The pool of competitors consists of several types of firms. First, the above-mentioned pre-reform NE-operators play an important role. These firms typically still own their old infrastructure, but they often have expanded their operations onto the network of Deutsche Bahn where they are exclusively responsible for the provision of downstream services.[21] Second, sometimes local public transport companies expand their activities into from, e.g., buses into the railroad sector. Third, some entirely new companies have been formed. Fourth, some railway operators are joint ventures between other companies, in some cases including *DB Regio*.[22] Finally, foreign firms have entered the market. Typically, they have taken over independent local operators; however, there are also examples of entry on lines that were previously operated by *DB Regio*.[23]

2.2 Hypotheses

We shall now introduce the two main hypotheses of the paper.

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[20]A related case concerns the important line Hamburg-Westerland, also in Schleswig-Holstein. Here, the successful *Nord-Ostseebahn* entered a very attractive bid, but apparently finds it difficult to break even. As a remedy, it is playing with the idea of increasing ticket prices for some passengers (Hamburger Abendblatt, 14/10/2005).

[21]In Baden-Württemberg, the main pre-reform operators were *Südwestdeutsche Eisenbahngesellschaft* (SWEG), *Württembergische Eisenbahngesellschaft* (WEG), *Hohenzollerische Landeseisenbahn* (HzL), *Albtalbahn-Verkehrsgesellschaft* (AVG) and *Oberrheinische Eisenbahngesellschaft* (OEG). SWEG, HzL and AVG have expanded their operations onto the Deutsche Bahn network, partly in joint ventures. OEG still concentrates on its old network; WEG has been taken over by *Connex.*

[22]In Baden-Württemberg, there are no examples of entirely new firms in the market. However, for instance, the *Breisgau S-Bahn* was founded jointly by SWEG and the *Freiburger Verkehrs AG,* the municipal transportation firm in Freiburg.

[23]An example of the former case is *Connex*, a multinational company based in France; an example of the latter case is the entry of Swiss firms on lines near the border: the state railway SBB near Basel and its subsidiary *Eurothurbo* near Lake Constance.

Hypothesis 1 *Competition increases the service level.*

This hypothesis reflects the simple intuition that competitive procurement has two main advantages for the agency. First, it allows to select the most efficient supplier (*selection effect*). Second, it puts pressure on all suppliers *(competitive-pressure effect)*. As a result, with competition, procuring any service level is less costly than without. Therefore, under reasonable preferences agencies prefer to ask for higher service levels with competition than without.

Because of the competitive-pressure effect, a positive effect of competition does not necessarily presuppose that the competitors are more efficient than the incumbent. However, if we do observe a change of operator as a result of the introduction of competition, this suggests that we are in an environment where competition is stronger (for instance, because there are more bidders) than when the operator does not change. If the agency has some idea about the strength of competition, it should ask for higher service levels where it expects competition to be strong. Combining these two insights leads to the second hypothesis.

Hypothesis 2 *Other things equal, the difference in service levels demanded by the agency under direct negotiations and competitive procurement is higher when competition leads to a change of operator than when it does not.*

To justify these hypotheses more carefully, we provide an extremely simple model that captures the essence of the argument. We think of the agency as procuring services that can potentially be delivered by firms $i = 1, ..., I$. The agency can either use *direct negotiations* with firm 1, the incumbent, or *competitive procurement* where all I firms can submit bids. In either case, the agency announces a service level q in the first stage of the game; in the second stage, a mechanism determines which firm, provides the service, and which transfer T_i it receives from the agency for each unit supplied.[24] The agency has a utility function $U(q) = V(q) - T_i q$, such that $V(0) = 0$; V is increasing, concave and bounded above. Each firm i has privately known constant marginal costs c_i, which are identically and independently distributed as $F^i(c_i) \equiv F(c_i)$ from the interval $[\underline{c}, \overline{c}]$; $\underline{c} > 0$; with density f such that $f(c_i) > 0$ in the interior of the interval.

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[24]Though the service level will correspond to the frequency of service in our empirical analysis, it could also be interpreted as an aggregate that includes contractible aspects of quality such as reliability, comfort and ticket prices, which are often part of the arrangement between agencies and contractors.

We suppose for simplicity that the agency is politically committed to procuring the service with probability 1.[25] For direct negotiations, the agency therefore confronts the incumbent with the desired level of q and a take-it-or-leave-it offer $T = \overline{c}$ for each unit of q supplied. Independently of q, the firm will then provide the service. The agency thus chooses q so as to maximize $(V(q) - \overline{c}q)$. The optimal service level is characterized by $V'(q) = \overline{c}$.

Similarly, to model *competitive bidding,* we use a first-price auction with reservation price $\overline{c}$.[26] The equilibrium bids per unit of firms with $c_i < \overline{c}$ are

$$B_i\left(c_i | \overline{c}\right) = c_i + \int_{c_i}^{\overline{c}} \left(\frac{1 - F(c)}{1 - F(c_i)} \right)^{I-1} dc < \overline{c}.$$

The mechanism therefore has the following properties.

(M1) An agency that asks for a service level of q in the first stage pays a higher transfer on expectation $(ET(q))$ under negotiations than under competitive bidding.

(M2) Under competitive bidding, the ex-ante winning probability $(\frac{1}{I})$ for any individual firm is higher the lower the number I of bidders.

(M3) Under competitive bidding, an agency that asks for a service level of q in the first stage pays a higher transfer on expectation the lower the number I of bidders.

Together, (M1)-(M3) imply the hypotheses. Hypothesis 1 immediately follows from property (M1): an agency that maximizes the expected value of $V(q) - ET(q)q$ chooses higher q the lower $ET(q)$. In particular, an agency that negotiates with the incumbent chooses lower service levels than if it procures the service competitively, other things equal. As to Hypotheses 2, by (M2), like every other bidder, the incumbent is less likely to win the higher the number of bidders. Conversely, if we observe that the incumbent wins an auction, it is more likely that the number of bidders is small.[27] Assuming that the agency anticipated a small number of bidders, however, it will optimally choose a lower service level by (M3).

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[25]See Che (1993) for a similar assumption.

[26]All standard auctions with optimally set reservation price are equivalent; but a first-price auction comes closest to actual practice.

[27]The argument can easily be formalized using Bayes' Law, assuming that the observer has a prior distribution on the number of bidders.

An obvious problem with the approach just described is that the choice between negotiations and auctions is not endogenized. If competitive procurement systematically leads to lower costs for the agency, why does it not always choose this alternative? There are several responses to this issue. First, industry practioners often point out the administrative costs of formal tenders. This could easily be addressed by allowing for a fixed cost of the auction mechanism. This approach would clearly imply that agencies choose those lines for competitive procurement where the difference in expected costs between negotiations and auctions is largest. If this was the whole story, then the past gains from competition might be larger than potential future gains from competition. Second, learning may play a role. Agencies might be uncertain about many aspects of competitive tendering, such as the reliability of potential contractors, the extent of competition, the best way to design the auction, etc. Therefore, they could rationally adopt a gradual approach to the introduction of competitive procurement. Third, obviously, agencies might have a hidden agenda, which might induce them to refrain from using competition even when it would be efficient to do so.

A related problem concerns the determination of the service level. Clearly, an ideal mechanism would attempt to elicit firm's private information to determine q. Che (1993) introduces such a mechanism. Agencies ask firms to submit offers (q_i, p_i), where p_i is the total payment. They specify a scoring rule $s(q_i, p_i) = V(q_i) - p_i$, so that the firm with the highest score is awarded the contract. Che shows that both first-score auctions and second-score auctions lead to bids such that the quantity maximizes $V(q_i) - c_i q_i$.[28] Clearly, this quantity is decreasing in a firm's marginal cost; it's expected value is therefore increasing in the number of firms. Using such multi-dimensional auctions, Hypotheses 1 and 2 could also be generated.[29] We chose the alternative approach where the agency prescribes the output level because it appears to be closer to reality.

3   Data and Methods

To test our hypotheses, we first require a measure of the service level. Ideally, such a measure should aggregate the frequency of service as well as aspects of quality

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[28]The terminology coincides with the more familiar teminology from one-dimensional auctions. In the first-score auction, the firm's offer is finalized as a contract; in the second-score auction, the firm must match the score of the highest rejected offer.

[29]For negotiations, the relevant mechanism would allow the firm to choose q itself, with a transfer payment of $V(q)$.

such as safety, comfort and prices. A good candidate for such a measure would be the number of passenger kilometers traveled on a line. This measure reflects the conceived service quality from the perspective of the passengers. Unfortunately, however, we only have rudimentary data on passenger kilometers, so that we used a less satisfactory measure, namely the *frequency of service*. We measure this frequency as the ratio between train kilometers per year (tkm) and the length of a line (lkm).[30] The frequency of service is an important aspect of the service level, but obviously not the only one.

To identify competition effects, we compare the evolution of the frequency of service in the group of competitive lines and the control group. We first introduce a definition for a competitively served line. To understand this definition, it is important to note that agencies do not necessarily procure all services on one line in the same fashion. For instance, in some cases, the agencies use competitive bidding for higher-level services (*Regionalexpress),* but procure lower level services on the same level directly from the monopolist, or conversely.

Definition 1 *A line is **served competitively** if, for at least 20% of the train kilometers that were provided on these lines in the year 2003/2004, one of the following conditions holds:*[31]
(i) The services were procured using a formal tender.
(ii) The services were procured on the basis of offers from at least two firms that were approached directly by the agency.
(iii) Apart from the incumbent, at least one firm offered a contract to the agency without having been asked to do so.
(iv) For reasons other than those given under (i)-(iii), the services were carried out by another firm than the former incumbent DB Regio.

Case (i) is the most important. The largest auction in Germany to date was carried out by VRN. *DB Regio* cast the successful bid for the *S-Bahn Rhein-Neckar,* a new metro system in the Heidelberg-Mannheim agglomeration, amounting to approximately 6 Mio. tkm per year (Die Welt 2001). Other major cases of competitive bidding in Baden-Württemberg included metro lines near Freiburg, Karlsruhe and

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[30]Thus, the frequency of service corresponds to the average number of trains per year on each kilometer of tracks.

[31] *The 20% cut-off value to identify competitively procured lines is somewhat arbitrary; as, on most lines, the following conditions (i)-(iv) hold either for a very small number of services or for a large number of services, the results are likely to be robust to the exact choice of the cut-off level.*

Offenburg and the *Ringzug,* involving 1.258 Mio. tkm per year in the eastern part of the Black Forest (Hohenzollerische Landesbahn 2001).

Case (ii) is quite common in general, but not in Baden-Württemberg.[32]

Case (iii) is rare in general, but it happened in Baden-Württemberg on one occasion: Starting from 2003, the lines Basel SBB – Zell im Wiesental and Weil am Rhein – Stetten were initially supposed to be served by the incumbent *DB Regio* jointly with SBB, the Swiss state railway company. Then SWEG submitted an unsolicited bid for both lines to which SBB reacted by submitting a bid without *DB Regio* (Wirtschafts- und Sozialdepartement Basel-Stadt 2002).

We included category (iv) because it appears plausible that if a firm takes over the duty of operating a line instead of *DB Regio,* it believes it can carry out the service more efficiently than the incumbent. A typical example is the line Schorndorf-Rudersberg near Stuttgart. In 1996, this line was "sold" for DM 1.- from the infrastructure operator *DB Netz* to the *Württembergische Eisenbahnge-sellschaft (WEG)* which now belongs to the *Connex* group. The new infrastructure owner also carries out the services on this line.[33]

Finally, we should point out that the group of competitive lines was not exclusively served by competitors of *DB Regio* in the year 2004. When the incumbent *DB Regio* won the bid, the line was obviously also included in the category of competitively served lines.

We first start with a simple descriptive approach to the problem. To identify the effect of competition, we compare the difference between the distribution of the frequency of service on the competitively served lines in 2004 and 1994 with the corresponding frequencies for the control group. Essentially, we speak of a positive competition effect when the growth in the frequency of service is larger in the competitive group than in the control group. Underlying this approach is the assumption that, without the introduction of competition, there would have been no systematic difference between the evolution of lines in the competitive group and those in the control group. However, the approach does not require the initial distribution of frequencies in the two groups to be similar.

For the simplest version of our investigation, we require the following information:

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[32]For instance, in nearby Bavaria, the agency *Bayerische Eisenbahngesellschaft* asked five operators directly to submit bids for about 1 Mio tkm on the line Munich-Oberstdorf (Bayerisches Staatsministerium 2003).

[33]In this example and several related cases, the new operator is vertically integrated, which is typically not the case in the other examples. There, the infrastructure is owned by *DB Netz,* whereas the services are provided by other firms (except when *DB Regio* is the successful bidder).

(1) A division of the passenger railway network in Baden-Württemberg into disjoint lines.

(2) The length of each line.

(3) The total train kilometers for each line in the years 1993/94 and 2003/04.

(4) For each line, information on whether it belongs to the competitive group or to the control group.

Items (1)-(3) were calculated from DB timetables, which involved substantial effort. We included those lines that were predominantly in the influence sphere of the agencies NVBW, VRN and VVS.[34] The division of the network into lines follows the 2004 timetable. Some adjustments were necessary, however, to avoid double-counting of trains. Lines that were closed down between 1994 and 2004 were not included.

Table 1 summarizes the data. There are 80 lines, 28 of which belong to the competitive category. In terms of length, 39% of the network are served competitively.[35]

Table 1: Local Passenger Lines in Baden-Württemberg

	Number of Lines	Percentage of Lines	Line-Kilometers	Percentage of Line-Kilometers
Without competition	52	65	2478	61
With competition	28	35	1565	39
Total	80	100	4043	100

Next, we consider the evolution of frequencies between 1994 and 2004. From Table 2, we observe:

1. a 29% increase in total transportation

2. a much stronger increase in the competitive group
   (45% vs. 22% in the control group);

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[34] A small number of these lines lies partly outside of Baden-Württemberg.

[35] Recall that on lines we defined as competitively served, not all the services are necessarily procured in a competitive fashion.

3. an increase in the number of lines operated at least partly by competitors of DB Regio from 19 to 39.

Table 2: The Evolution of the Market (Overview)

	1994	2004	%-change
Total tkm (/1000)	65857	85255	29
tkm on lines without competition (/1000)	43769	53199	22
tkm on lines with competition (/1000)	22089	32057	45
tkm with competition (%)	34	38	12
number of NE-lines	19	39	105
percentage of NE-lines	24	49	105
lkm on which NE-operators are active	719	1888	163
% of lkm on which NE-operators are active	18	47	163
number of AVG lines	3	12	300
tkm supplied by AVG (/1000)	3839	15386	301

Notes: NE refers to all operators except Deutsche Bahn (DB). AVG is a NE operator.

The aggregate results in Table 2 suggest an increasing importance of competitive procurement mechanisms. It is unclear, however, whether this effect merely reflects that a growing number of lines have been exposed to competition or whether the lines that have been subjected to competition have actually grown faster than others.

4   Results

We now present our main observations about the evolution of the frequency of service. Before describing the estimation results, we present our results using simple tables and figures.

4.1   Descriptive Statistics

First, we describe the evolution of total transportation.

Result 1 *In the period under consideration, the frequency of service in Baden-Württemberg has increased substantially.*

Table 3: Frequency of Service (Service level)

	1994	2004
10th percentile	6.045	6.784
Median	12.815	17.367
90th percentile	28.827	49.413
mean	16.015	21.963
standard deviation	12.145	15.508
Number of lines	80	80

Table 3 compares the main indicators of the distribution of the frequency of service for 1994 and 2004. The table shows a clear increase in the various percentiles and the mean.

Figure 1 confirms this result. It shows that the density function for the frequency of service has moved to the right between 1994 and 2004.[36]
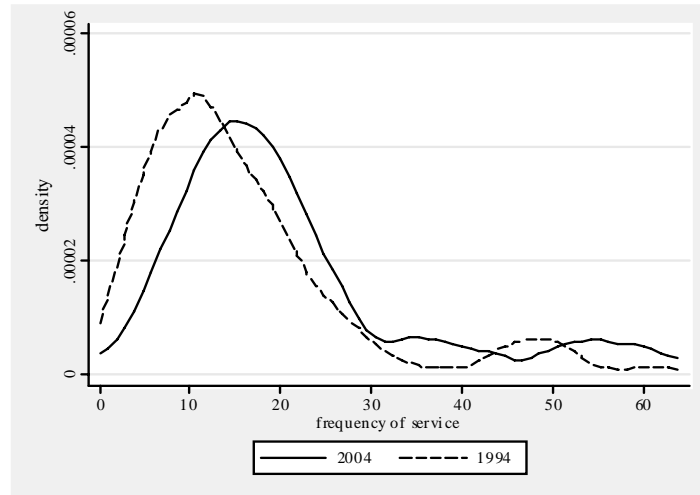
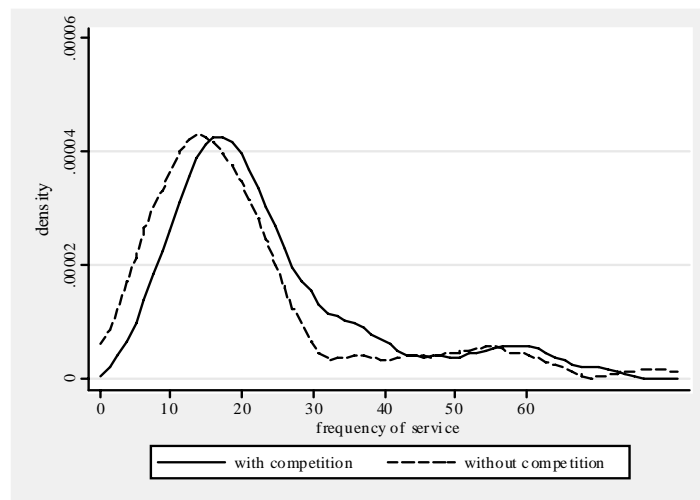**Figure 1:** The change in the frequency of services (1994 vs. 2004)

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[36]Here and in the following, the graphs were obtained using Epanechnikov kernel density estimators (with bandwidth $h = 0.9 \widehat{\sigma} n^{-1.5}$, where n is the number of observations, $\widehat{\sigma} = \min \left\{ S, \frac{IQR}{1.349} \right\}$, S is the standard deviation and IQR the interquartile range).

Obviously, the change between 1994 and 2004 only reflects an expansive policy; in itself, it says nothing about an effect of competition. Figures 2 and 3 are more helpful in this respect. Figure 2 compares the estimated densities of the frequency of services for the competitive group and the control group in 2004. The figure suggests the following result.

Result 2 *The frequency of services in the competitive group was higher than in the control group in 2004.*

Figure 2: The frequency of services on competitive and non-competitive lines (2004)

The result corresponds to the observation that the density for the competitive group lies further to the right than for the control group. Obviously, this observation does not necessarily imply a competition effect in itself. It is conceivable that it merely reflects a selection effect, namely that more attractive lines are exposed to competition more often than less attractive lines. In the concrete example, this natural suspicion turns out to be unjustified, even though on a considerable fraction of lines in the competitive group the frequency of service in 1994 was already substantial, for instance on those lines that were subjected to the competitive bidding for the Rhein-Neckar metro system or on most of the lines that were taken over by the *Albtalbahn-Verkehrsgesellschaft (AVG)* in the Karlsruhe area. This effect was counterbalanced by the fact that many lines in the competitive group had a very low frequency of service in 1994. The most spectacular example is the line from

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Schorndorf to Rudersberg, on which *DB Regio* supplied only 4607 tkm/lkm in 1994, while *Connex* supplied 15.558 tkm/lkm in 2004.
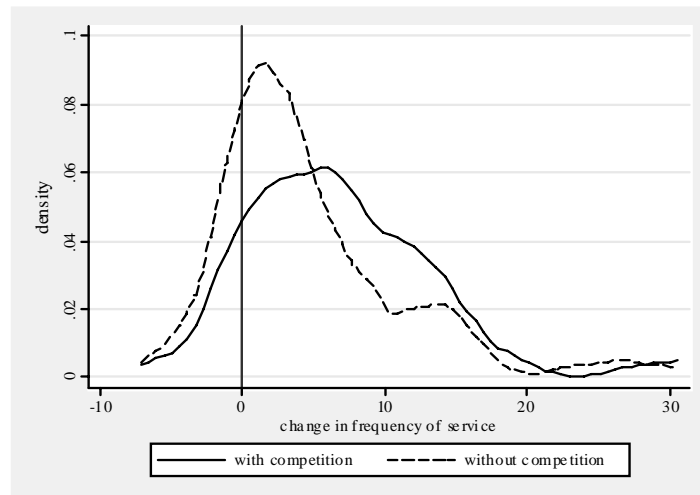
Figure 3: Change in the frequency of services on competitive and non-competitive lines

Figure 3 displays the densities of the change in the frequencies of service between 1994 and 2004 for the competitive and non-competitive lines. Clearly, competitive procurement corresponded to higher growth in the service level. This means that competitive lines were not characterized by higher service levels in 1994. Rather, the fact that the frequency of service is higher on competitive lines compared to non-competitive lines appears to be a competition effect.

Result 3 *On lines that were exposed to competition between 1994 and 2004, the frequency of services grew more strongly than in the control group.*

As argued earlier, we interpret this as a competition effect. When faced with a set of potential contractors rather than with a monopolist, agencies can ask for better service levels without necessarily having to pay high transfers.

At this stage, it is worth bearing in mind that our analysis lacks subsidy data. Thus, we cannot provide direct evidence for greater "value for money" in the procurement of railroad services. For instance, agencies who choose to procure competitively may feel compelled to make sure the public perceives this act as a success story, in which case they might be prepared to accept high transfers to guarantee high service levels.

5 Econometric Analysis

In the following, we shall investigate whether the competition effect suggested by Result 3 survives under closer scrutiny. We shall first analyze more carefully whether the lines subjected to competition are different from the lines in the control group. We shall then use these insights to carry out an econometric analysis of the determinants of the change in service levels. Finally, we consider the effects of ownership.

5.1 Selection of Competitive Lines

Observers of the German railway industry frequently complain that the lines that are procured competitively tend to be "lemons", that is, unattractive lines with low service levels and low growth prospects. Our descriptive analysis in the last section suggests that this is not true for the special case of Baden-Württemberg. Nevertheless, we now analyze more carefully whether the lines in the treatment group are indeed systematically different from those in the control group.

Most of our explanatory variables relate to the attractiveness of the lines, which is mostly determined by geography. Specifically we consider the geographic distance to the nearest city with at least 100,000 inhabitants as a measure of remoteness. Further, we include the size of both the biggest and the second-biggest city in 1994. Next, importantly, we consider the population growth between 1994 and 2004 in the two major cities. If there is a systematic trend difference between lines in the competition group and the remaining lines which leads agencies to ask for a greater service increase in the former group than in the latter, this could well be reflected in population growth.

In addition, we include a dummy variable to check whether a line is electrified or not. The prime motivation for doing so is that electrified lines are likely to be more attractive than lines that are not. Also, one might imagine that agencies are more reluctant to subject electric lines to competition because one would imagine that successful bidding by entrants is less likely on these lines. Finally, we include three agency dummies, taking values of one when the line in question is procured exclusively by one of the three agencies; the reference case where all agency dummies are zero thus relates to the situation that several agencies procure the services.

Table 4 gives simple descriptive statistics. The results suggest that there is little reason to believe that lines with competition are systematically less attractive than lines without competition in terms of exogenous characteristics. On the one hand, the lines in the former group tend to be somewhat less attractive in the sense that

they are less populated and show less population growth. On the other hand, the competitive lines tend to be less remote, and a much greater percentage of the lines in the competition group is electrified (64.3 as opposed to 48.1% in the control group). A probit analysis reported in Table A1 in the Appendix gives a similar picture.

Table 4: Characteristics of Lines by Competition Status in 2004

	With competition	Without competition	Difference (abs z-Value)
Distance to nearest city (km)	7.857	18.135	-10.277
			(-1.838)
Population in community 1 (1994; 1000)	166.640	214.781	-48.141
			(-1.017)
Population in community 2 (1994; 1000)	41.614	52.099	-10.485
			(-0.774)
Population growth in community 1 (%)	2.400	2.970	-0.570
			(-0.585)
Population growth in community 2 (%)	3.475	3.446	0.029
			(0.029)
Electricity	0.643	0.481	0.162
			(1.386)
Length (km)	55.893	47.654	8.239
			(0.863)
Agency (Other)			
VVS	0.036	0.115	-0.080
			(-1.199)
VRN	0.179	0.212	-0.033
			(-0.348)
NVBW	0.571	0.442	0.129
			(1.097)
Lines	28	52	

Notes: Community 1 is the largest community, and community 2 is the second largest community along the railway line.

The picture presented here is likely to be specific to Baden-Württemberg, where in essentially all of the major cities a substantial part of the "S-Bahn" (Metro) traffic is procured competitively. This is highly unusual in the rest of Germany, where there seems to be clearer evidence for the "lemons"-hypothesis.

The results in Table 5 extend the point just made, and they cast even more doubt on the idea that lines in the competition group are systematically less attractive than lines in the control group. The results allow us to understand what

the explanatory variables just discussed have to say about differences in ex-ante service levels. The first column in the table shows that there is hardly any ex-ante difference between lines with and without competition. The second column uses the additional independent variables discussed in Table 4 as controls. After introducing them, there is a mild tendency in the direction that competitive lines are slightly more attractive than those in the control group, but this tendency is weak.

Table 5: Explaining Ex ante Differences in Service Level
Dependent Variable: Service Level in 1994

With competition	0.040	0.936
	(0.02)	(0.35)
Distance to nearest city (km)	-	-0.034
		(0.86)
Population in community 1 (1994; 1000 inhabitants)	-	0.023
		(1.21)
Population in community 2 (1994; 1000 inhabitants)	-	0.036
		(1.51)
Pop. in comm. 1 * length (/100)	-	-1.046
		(0.57)
Electricity	-	4.807
		(1.71)*
Length (km)	-	0.017
		(0.59)
Agency (Other)		
VVS		15.026
		(2.19)**
VRN		9.214
		(2.88)***
NVBW		4.705
		(1.83)*
Constant	16.001	2.268
	(8.54)***	(0.61)
F-test, pop. in comm. 1 and 2	-	2.72*
Observations	80	80
R-squared	0.00	0.44

Notes: Absolute z-Value in parenthese (based on robust Huber-White standard errors). * significant at 10%; ** significant at 5%; *** significant at 1%. Service level is train kilometers per line kilometers.

Also, the effects of the additional controls on ex-ante service levels are plausible. First, the significant coefficients suggest that electrified lines and lines that are in the agglomerations of Stuttgart (VVS) and Heidelberg-Mannheim (VRN) have substantially higher service levels. Second, though the population-related variables are not significant individually, they are jointly significant, and their effect is plausible: The greater the population of each of the two biggest cities on the line, the higher the ex-ante service levels. Also, the role of the interaction term between population in community 1 and the length of the line is interesting. Though the coefficient is

not significant, it suggests that the influence of the population in the largest community on service levels is smaller when the line is longer. This clearly corresponds to intuition: A line that connects the largest city in the country, Stuttgart, with some remote part of the Black Forest should be expected to be served less than a line that lies almost entirely in the agglomeration.

Summing up, there is no selection effect of competitively procured lines with respect to the characteristics we observe. In a similar vein, the competitively procured lines are not systematically different from the control group in terms of the service level before the introduction of competition. This is evidence in favor of our main identifying assumption that lines with competition would have involved in much the same way as lines without competition if they had not been subjected to competitive bidding.

5.2 Competition Effects

We now use the control variables just introduced to explain the differences in the changes in service levels better. Table 6 contains the results. The first column essentially restates our earlier observation of a positive competition effect (Result 4). The remaining columns show the effects of introducing control variables.

Consider the second column. Most importantly, lines with high initial population in the largest community experience higher growth, and this effect is more pronounced for shorter lines. The remaining coefficients are insignificant. By adding two variables relating to the population growth in the biggest and second-biggest city, the model presented in Column 3 deals with the conjecture that changes in the service level demanded by the agencies may reflect actual and expected population changes. Though indeed service levels seems to grow slightly more rapidly on the lines expecting greater population growth, the effect is both insignificant and negligible in size.[37]

As the first row of Table 6 clearly shows, both of the extended models suggest that the competition effect is remarkably robust, with the size and significance of the competition coefficent being almost unchanged in the three different models.[38] In a

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[37]A one percentage point increase in population growth is associated with an increase in service quality of 99 train kilometers per line kilometer.

[38]Note that inference is based on Huber-White standard errors. We have also examined inference based on standard errors clustered at the agency level. These standard errors are smaller than the standard errors reported in Table 6. In order to perform a conservative test of significance of the competition effect, we base inference on standard errors that do not allow for clustering at the agency level.

Table 6: Exploring the Effect of Competition on Service Level
Dependent Variable: Change in Service Level 1994 to 2004

With competition	3.319	3.758	3.825
	(1.77)*	(2.20)**	(2.20)**
Distance to nearest city (km)	-	0.022	0.024
		(0.83)	(0.89)
Population in community 1 (1994; 1000 inhabitants)	-	0.021	0.022
		(2.18)**	(2.28)**
Population in community 2 (1994; 1000 inhabitants)	-	-0.003	-0.001
		(0.14)	(0.03)
Pop. in comm. 1 * length (/100)	-	-0.015	-0.017
		(1.42)	(1.49)
Electricity	-	2.356	2.518
		(1.40)	(1.54)
Length (km)	-	-0.025	-0.020
		(1.08)	(0.83)
Agency (Other)			
VVS	-	-5.049	-5.572
		(1.30)	(1.34)
VRN	-	-0.468	-0.291
		(0.14)	(0.09)
NVBW	-	-1.062	-1.250
		(0.39)	(0.45)
Population growth in community 1	-	-	0.099
			(0.63)
Population growth in community 2	-	-	0.119
			(0.80)
Constant	4.786	3.233	1.245
	(5.19)***	(1.03)	(0.44)
F-test, pop. in comm. 1 and 2	-	2.45*	2.73**
Observations	80	80	80
R-squared	0.04	0.25	0.27

Notes: Absolute z-Value in parenthese (based on robust Huber-White standard errors).
* significant at 10%; ** significant at 5%; *** significant at 1%. Service level
is train kilometers per line kilometers.

supplementary analysis that is available on request, we address another robustness
concern. One might be worried that some of the explanatory variables are highly
correlated. Indeed, these concerns are justified. However, we show that excluding
the variables under consideration does not lead to substantial differences in the
estimates of the competition effect.[39]

5.3 Operator Effects

The results sketched so far suggest a positive competition effect. However, we have
not yet shown whether competitive pressure suffices to generate the effect or whether
a change of the operator is needed. Out of the 28 lines subject to competitive
bidding, 8 lines were won by DB Regio, 7 lines were won by AVG – the largest

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[39]Specifically, the population in the largest community is strongly correlated with population
in community 2, growth of population in community 2, the interaction term between length and
population in the largest community and electrification. In the modified regression, we drop all
but the first variable.

NE-operator in Baden-Württemberg that operates in the Karlsruhe area– and the remaining 13 lines were won by smaller NE-operators. Thus, it is not clear whether a change of ownership from DB Regio to an NE-operator is necessary for an improvement in service levels.[40]

Table 7 is a first step towards disentangling the effects of competition and ownership. The left-hand column is identical with the last column in Table 6, that is, there are no controls for ownership. The right-hand column controls for ownership. The reference case is a line operated by *DB Regio* in 2004. In addition, we use two dummies to distinguish between two types of NE lines, those operated by AVG and those run by the remaining NE lines. The motivation for doing so is that the AVG is a particularly large operator, the expansion of which was pushed by local policy.

Our results show that operator effects seem to matter. First, the positive signs of the pure ownership dummies (AVG and NE other than AVG) suggest that, in the absence of competition, both types of lines saw stronger growth than the *DB Regio* lines; note, however, that neither effect is significant. Second, the interaction terms show that competition effects are heterogeneous, though the effects are again not quite significant. For lines operated by *AVG*, the competition effect is much stronger than for the baseline case of DB Regio. For the remaining NE-operators, there is essentially no competition effect.[41] By and large, there is not much support for Hypothesis 2. It does not seem that the competition effect is larger when the operator changes than when it does not.

6   Summary and Discussion

The preceding results show that there are positive effects of competition for the passenger railway market on service levels. In this section, we embed our findings in a broader context and we discuss possible extensions.

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[40]Given the small size of our sample and specifically the fact that there are only 28 members of the competition group, it is impossible to draw far-reaching conclusions about the relation between ownership and performance. However, the following observations suggest why such an analysis might be instructive at the national level.

[41]The positive overall competition effect of 3.595 and the negative effect of -3.687 captured in the interaction term "With competition*NE, excl. AVG" essentially cancel out.

Table 7: Competition vs. Ownership
Dependent Variable: Change in Service Level 1994 to 2004

With competition	3.825	3.595
	(2.20)**	(1.94)*
With competition * operated by AVG	-	6.851
		(1.30)
With competition* operated by other NE (excl. AVG)	-	-3.687
		(1.20)
Distance to nearest city (km)	0.024	0.060
	(0.89)	(1.96)*
Population in community 1 (1994; 1000 inhabitants)	0.022	0.028
	(2.28)**	(2.61)**
Population in community 2 (1994; 1000 inhabitants)	-0.001	0.000
	(0.03)	(0.00)
Pop. in comm. 1 * length (/100)	-0.017	-0.016
	(1.49)	(1.35)
Electricity	2.518	-0.991
	(1.54)	(0.54)
Length (km)	-0.020	-0.008
	(0.83)	(0.33)
Agency (Other)		
VVS	-5.572	-3.519
	(1.34)	(0.88)
VRN	-0.291	1.977
	(0.09)	(0.63)
NVBW	-1.250	-0.963
	(0.45)	(0.37)
Population growth in community 1	0.099	-0.094
	(0.63)	(0.52)
Population growth in community 2	0.119	0.359
	(0.80)	(1.84)*
Operator (DB)		
AVG	-	4.735
		(1.32)
NE (excl. AVG)	-	3.642
		(1.23)
Constant	1.245	-1.413
	(0.44)	(0.42)
Observations	80	80
R-squared	0.27	0.39

Notes: Absolute z-Value in parenthese (based on robust Huber-White
standard errors). * significant at 10%; ** significant at 5%; ***
significant at 1%. Service level is train kilometers per line
kilometers.

6.1 Why does Franchising Seem to Work?

Going back at least as far as Williamson (1976), many authors have questioned whether competitive franchising can work in practice. For instance, Vickers and Yarrow (1989) have identified three potential pitfalls of franchising, namely inadequate contract specification and monitoring, lack of competition and problems of investment distortions from asset handover.

The main concern resulting from *incomplete specification of contracts* is that franchisees might provide inefficiently low quality to be able to submit competitive price bids. Theories of government procurement with incomplete contracts (Hart et al. 1997) suggest that these concerns would appear to be particularly justified when competition also leads to privatization, as is often the case in the German railway sector. However, there is little reason to believe that non-contractible quality has been reduced as a consequence of competitive franchising and privatization. First, to the extent that quality problems are contractible, the agencies make ample use of this opportunity. Indeed, railway operators are often complaining that the detailed contractual specification of many aspects of quality means that the efficiency potential of competition is not fully exploited.[42] Second, concerning those aspects that are not contractible, reputation mechanisms keep the scope for shirking on quality under control. Vis-à-vis the agencies, operators have an incentive to develop a reputation for quality to be in a good position in future auctions, including those on other lines. Vis-à-vis the consumers, operators have an incentive to perform well as they typically benefit from higher revenues. As a result, it is not surprising that (possibly biased) anecdotal evidence suggests that, if anything, competition has a positive effect on patronage.[43] Finally, several important aspects of the quality of railway services, such as safety and punctuality, are only partly under the control of the operators who are competing for contracts. The network owner plays a much more important role for these components of quality, as the ill-famed British railway privatization showed. Also, even where quality problems such as delays are caused by railway operators in Germany, this appears to be totally unrelated to the in-

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[42]Obviously, as Viscusi et al. (2000, 403) put it, the precise specification of quality runs against the "minimal role of government" as the "main attraction of franchise bidding". In his case study of the competitive bidding for a long-term electronic distribution contract by London Underground, Littlechild (2002) similarly argues that considerable resources had to be spent on the formulation and monitoring of the contract to guarantee an efficient functioning of franchise bidding.

[43]For instance, Allianz pro Schiene (2006) compiles 16 examples of successful regional passenger lines in Germany, 14 of which are characterized as competitive according to our definition. On most of these lines, the patronage has grown substantially over the last decade, typically by a factor of 2-5, which by far exceeds the growth of the frequency of service.

troduction of competition or to entry of new firms.[44] All told, there appears to be little reason to believe that competition has had an adverse effect on the quality of service.

With rare exceptions, *lack of competition* does not appear to have been a problem so far (Lalive and Schmutzler 2006), but this might change in the future. First, markets are clearly showing signs of consolidation, with multinational firms taking over small players. Collusion might therefore become more important. Second, as franchises are up for renewal, incumbency bias may play an increasing role.

Finally, *distortions of investment incentives* related to asset handover are partly circumvented by the long-term nature of many franchises. They are also mitigated by the fact that the specifity of train operators' capital is limited, because the market for rolling stock is reasonably well-developed and most firms can use their material in more than one franchise area.

Summing up, the agencies appear to be aware of the potential problems, and they reply by specifying contracts in sufficient detail and, in addition, making suppliers the residual claimants from higher quality.

6.2 Related Franchising Experiences

We briefly compare our findings to related experiments with franchising. Within the European railway industry, the two other main cases of competitive franchising concern the passenger railways the U.K. and Sweden. Though both cases differ from each other and from the German case in important details, there is a widespread opinion that competition for the market is working. For the U.K., Pollitt and Smith (2001) and Cowie (2002) report positive efficiency effects, Alexandersson and Hultén (2005) make similar claims for Sweden. Deteriorations in non-contractible quality do not appear to be an issue inasmuch as train operators are concerned. Quality problems that have loomed large in the U.K. case have mainly been related to the network, resulting from inefficent investment incentives for the owner related to vertical separation. To the extent that competition in the downstream sector usually implies some degree of separation between network ownership and operations, one might of course argue that network quality deterioration is a hidden cost of competitive franchising. However, such problems would still arise under vertical separation without competitive franchising.

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[44]For instance, in the period under consideration, the state-owned operator *DB Fernverkehr and Reisen* often experienced problems with its long-distance trains, leading to delays that also had adverse consequences for the punctuality of regional passenger traffic.

Beyond the railway industry, one can point to the substantial experience with franchising in the bus industry. Hensher and Wallis (2005) summarize the international evidence, suggesting that cost savings from competitive tendering are typically in the order of magnitude of 20-30%. However, the experience is very heterogeneous. On the one hand, the early phase has been regarded as particularly successful, with cost reductions of 47% per bus mile in just over ten years (White 2000). On the other hand, Boitani and Cambini (2006) compile descriptive evidence on Italy, showing very small efficiency effects of competitive tendering. They attribute this failure to a bias of the authorities towards local firms. On priori grounds, one would expect competition in the railway industry to be more difficult to implement than in the bus industry, mainly because of the greater need for horizontal and vertical coordination.

6.3   Limitations and Extensions

There are several limitations of our approach. For instance, one might argue that the lines in the control group are also subject to some degree of competition, because *DB Regio* might fear that uncooperative behavior induces the agency to resort to competition in the future, or that it reduces its chances to succeed on the competitive lines. However, this would suggest that our analysis underestimates the effects of competition. Also, as argued before, the causal relation between competition and the growth of service can be questioned.

Even though the obvious concern that firms may reduce non-contractible quality does not seem a major issue in the case at hand, we do not want to overstate the normative significance of our analysis. Most importantly, we do not analyze whether the level of federal transfer payments that flows into the operation of regional passenger railways (around five billion Euros per year) is adequate from a welfare perspective. Moreover, one might argue that, at least on the more congested lines, additional passenger services take away scarce capacities which are needed for freight or long-distance passenger transportation.[45] However, our analysis is merely concerned with whether competitive procurement is a more effective way of achieving the goal of increasing regional passenger transportation than monopolistic procurement; we do not discuss the goal itself.

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[45]However, it should be noted that on the majority of lines in our sample there are no severe capacity problems. Though the network in Germany is much less dense than it was in the heydays of railway transportation, there has been no equivalent to the 'Beeching axe' in the UK which led to the closure of most rural low-frequency lines in the nineteen sixties.

In view of the preceding discussion, several important extensions of the paper suggest themselves. First, one could extend the analysis to the entire country. This is possible in principle, but labor-intensive. Second, it would be desirable to use alternative measures of performance. In particular, we shall try to supplement our analysis at least partly with data on passenger kilometers. This would not only be useful to improve the analysis of the effects of competition on service levels; it would also help to understand more about the relation between supply quality and patronage. At present, however, we are concerned about data limitations. Third, we would like to to use efficiency measures rather than pure output measures. From a policy perspective, it would be interesting to use data on transfers per line-kilometer. It will be impossible to obtain data on the changes in transfers at the required geographical level. Nevertheless, some information on the effects of competition can be obtained by exploiting the relation between required transfers and the extent of competitive procurement at the state level.

7 Appendix

Table A1: Determinants of Competition (Probit Analysis)
Dependent variable: With competition

	Coeff. (z-Value)	M.E.
Distance to nearest city (km)	-0.023	-0.008
	(1.86)*	
Population in community 1 (1994; 1000 inhabitants)	-0.003	-0.001
	(1.80)*	
Population in community 2 (1994; 1000 inhabitants)	-0.006	-0.002
	(1.60)	
Pop. in comm. 1 * length (/100)	-0.057	-0.020
	(0.27)	
Electricity	1.219	0.407
	(2.85)***	
Length (km)	0.007	0.002
	(1.33)	
Agency (Other)		
VVS	-0.800	-0.229
	(1.06)	
VRN	-0.430	-0.142
	(0.83)	
NVBW	-0.284	-0.101
	(0.62)	
Constant	0.190	
	(0.27)	
Lines	80	
log Likelihood	-41.39	

Notes: Absolute z-Value in parenthese (based on robust Huber-White standard

8   References

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