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Chapter 1

Introduction

According to the IBM[1] RAIL LIBERALIZATION INDEX Kirchner (2011), Austria has since April 2011 been part of the advanced group of liberalized rail transport in Europe. The IBM monitoring reports that access to both freight[2] and train operating companies[3] is well established. Competition in the rail freight market is already established and competition in the commercial passenger rail transport market has started in December 2011.

In contrast to other countries in the advanced liberalized group, the Republic of Austria has a direct negotiated contract with the incumbent operator ÖBB PERSONENVERKEHR to operate non-commercial passenger rail transport on fix defined lines. But there is an opening clause, so that eventually these public transport services can be tendered one dayKirchner (2011).

When the question whether to tender or not to tender has been decided, the central question remaining is: 'What to tender?' This thesis is analyses the implications of different object designs in a public rail transport tender. As a result of the ongoing liberalization of the European transport markets, the highly subsidized public transport services will be increasingly tendered so that the company with the highest bid will win the tender, and will be awarded the concession and will thus have to perform the service for a fixed

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[1] AN AMERICAN BASED IT-SERVICES COMPANY

[2] Freight Operating Company (FOC) is a company which offers cargo rail services

[3] Train Operating Company (TOC) is a company which operates passenger rail services

period of time. That means that the train operating company does not only have the right to run the public transport services, but in fact the train operating company has the duty to run the public transport services for a fixed amount of subsidies.

With the formal privatization and the internationalization process of national public transport providers and the concentration process between private public transport companies and former national public transport companies, the market concentration is ever more increasing.[4] In all auctions the same international companies are bidding for licenses at an increasing frequency rate. Therefore the main challenge of the orderers of the regional passenger rail transport is to save a sustainable and contestable market environment.

The central idea of this thesis is to find what object design is optimal to auction while minimizing public spending on transport services and at the same time sustaining a competitive and contestable market environment. Thus the research questions are the following:

1. *Which object design minimizes public spending?*

2. *Which object design makes a tender more contestable?*

The idea is to combine modern microeconomic theory and applied economic research. Therefore standard auction and game theory are used for predicting an outcome of different object designs.

In chapter two, the author provides the technical and economic market background which is useful to understand the current tender designs. In chapter three you will find the general characteristics of an offer auction, in particular the market organization, the obejct and the auction design. The assumptions for the benchmark are outlined in chapter four. In chapter five the author tries to give an answer to the first research question by benchmarking the

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[4]The concentration process has started in 2008 with the acquisition of Abellio by Nederlandse Spoorwegen (NS), the acquisition of Keolis by the Société Nationale des Chemins de fer français (SNCF) 2010, also 2010, the acquisition of Arriva by Deutsche Bahn (DB) and Arriva Germany by Ferrovie dello Stato (FS).

four different auction object designs in a private value setting. In chapter
six focus lies on the second research question. Section seven comprises the
conclusion.

Chapter 2

The Passenger Rail Transport Industry

2.1 Four Levels of Rail Transport

Passenger transport is very similarly organized in many European countries. There are four levels of transport. On the highest level are high speed trains which often operate on a network of their own and connect European metropolitan areas.[1] On the second level there are InterCity[2] trains, which connect large cities with metropolitan areas. These two types of trains are the so called long-distance trains and are in this thesis referred to as first-tier and second-tier trains. On the third level there are fast-stopping-trains[3]. They connect large cities or metropolitan areas with medium sized towns. And finally on the lowest level, there are stopping-trains and rapid transit systems. Stopping trains are trains [4] which connect large cities and medium-sized towns with small towns and villages. Rapid transit systems[5] are the

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[1]In Austria: ÖBB Railjet

[2]Often known as EuroCity or Corail in France. In Austria: ÖBB-InterCity, ÖBB-EuroCity and since December 2011 WESTbahn

[3]In Austria: RegionalExpress (REX)

[4]In Austria: Regionalzug (R)

[5]In Austria: S-Bahn (S)

backbone of city and suburban transport in metropolitan areas. In the following, the fast-stopping-train and the stopping-train/rapid-transit-train will be called third and fourth tier train. There is an overview about the four levels in Table 2.1.1.

Type	Level	Function
high speed train	first-tier train	connects metropolitan areas
InterCity	second-tier train	connects metropolitan areas with large cities
fast-stopping train	third-tier train	connects large cities with medium-sized towns
stopping train/rapid transit	fourth-tier train	connects medium-sized towns with small towns and villages/city center and suburban railway system

Table 2.1.1: Four Levels of Transport
(Source: authors' own illustration)

To the authors knowledge, all first-tier trains in Europe are profitable[6] and operated by publicly owned monopolists at their own business risks but more and more by now being run by private companies[7]. For InterCity trains this is different. In Great Britain tender about subsidies is common, the so-called Intercity-franchises, but there is the possibility of open access for commercial InterCity lines[8]. The InterCity trains are subsidized without tender in many European countries, for example, in Austria, France or the Netherlands. InterCity services without financial support operate in Scandinavian states or Germany. So the profitability of InterCity lines is not secure. This thesis is about subsidized rail transport and thus mainly about fast-stopping trains and stopping trains. This is illustrated in figure 2.1.1. The higher the transport level, the higher is profitability, too.

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[6]E.g. the ICE in Germany or the TGV in France
[7]E.g Nuovo Trasporto Viaggiatori (NTV) in Italy
[8]E.g. First Hull Trains
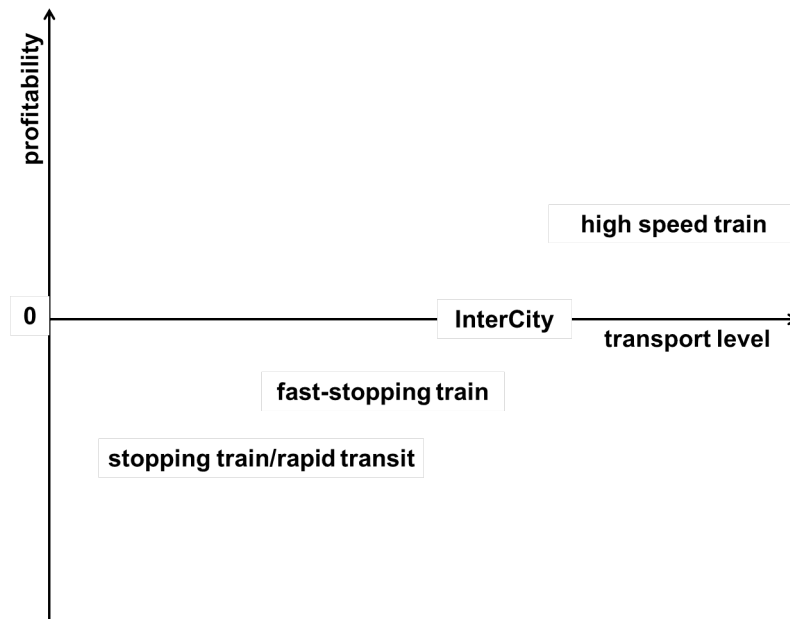
Figure 2.1.1: Four Levels of Transport
(Source: authors' own illustration)

Different railcars are needed. It is clear that it is not possible to operate high-speed services with stopping train rolling-stock and vice versa, it is not possible to operate a rapid transit system with high speed trains. But it is also not very useful to use fast-stopping trains to operate an InterCity or a stopping train service. Every level needs its own rolling stock. So every railcar is specified according to the level of the service it helps to provide. Furthermore there is a specification according to standards applied in each country. But it is possible to change this specification without high expenditures.[9] So there is a secondary market for railcars, which means that the investment cost for railcars is not sunk.

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[9]Especially in countries like Austria, Germany and Switzerland technical standards are very similar. So there is a common market for railcars. For example, the Hamburg-Köln Express GmbH will start long-distance operations in Germany with former ÖBB railcars.

2.2 Vertical Separation of Passenger Rail Transport Industry

First of all it is important to know that the regional and city public transport services in Europe are highly subsidized services. The states decide to provide a system of public transport facilities to their citizens. A frequent interval timetable is very expensive and only profitable at peak times. To ensure a stable and frequent public transport service, the state has to subsidize the public transport operator.

Secondly, it is important to know that in economic policy there exists a difference between providing and producing a public service. On the one hand, a public authority can provide and produce a public service like collective security. And on the other hand, a public authority can provide a public service by ordering a public service for the citizens from a private company. This is, for example the case in providing public motorways.

This means that if the state produces a service this implies that the state also provides the service. But if the state does not produce a public service, this does not imply that the state does not provide a public service. In order to provide a certain service, the state does not actually need to produce it.

Now a European state has basically two possibilities to provide public rail transport. One way is by means of an in-house solution where a state-owned network operating company[10] also offers transportation services. The other solution is that the state decides to provide the services by tender.

Furthermore in the model, gross and net contracts are discussed. As shown in Figure 2.2.1, in the case of net contracts the tender only contains railway operations on the network. So the railway network as the upstream industry is provided by a public entity. Therefore the downstream part of the railway transport industry consists of two different value-added levels. One level is the train-operating business of rolling stock. Here the objective function is a

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[10]network operating company (NOC): company which is the asset manager of the rail network

cost function and the operator has to minimize the cost of train operating. This sector is particularly affected by maintenance work and operational planning or more generally by production. The second level is the marketing of the product. Here the objective function of the seller is a revenue function, with the seller having to solve a maximization problem. Since this sector is strongly determined by marketing, the main task in this is to maximize revenues. In case of net contracts there is an integrated downstream industry, where a train operating company is responsible for production and marketing and therefore has to bear both cost and revenue risk.

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┌─────────────────────────┐   ┌─────────────────────────┐
│  ┌───────────────────┐  │   │  ┌───────────────────┐  │
│  │     UPSTREAM      │  │   │  │    DOWNSTREAM     │  │
│  └───────────────────┘  │   │  └───────────────────┘  │
│                         │   │                         │
│  ┌───────────────────┐  │   │  ┌───────────────────┐  │
│  │   RAIL NETWORK    │  │   │  │ TRAIN OPERATIONS &│  │
│  │                   │  │   │  │     MARKETING     │  │
│  └───────────────────┘  │   │  └───────────────────┘  │
└─────────────────────────┘   └─────────────────────────┘
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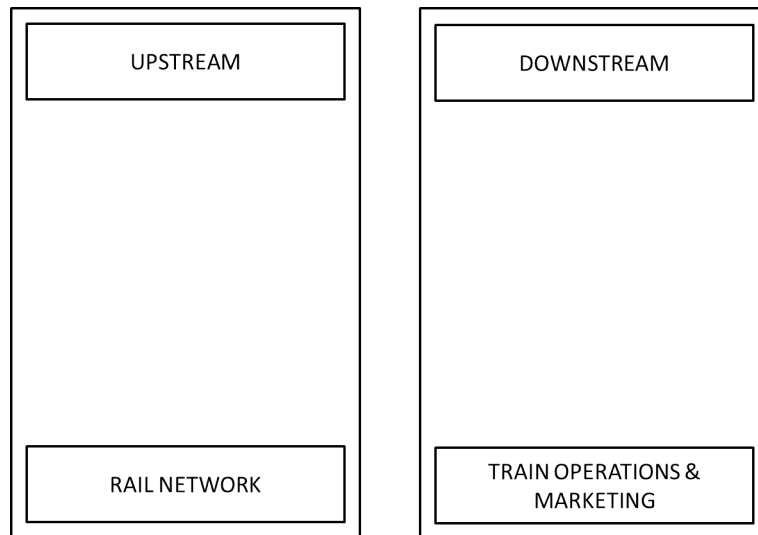
Figure 2.2.1: Integrated Downstream Industry
(Source: authors' own illustration)

If there are no synergies between operating a rail network and selling tickets, respectively between marketing and production, one can split the downstream industry into a midstream industry, which operates the services and faces the cost risk, and a downstream industry which sells the tickets and faces the income risk like in Figure 2.2.2. That means that the state provides and maintains the rail network, while at same time it also provides the production and sales of the rail operations via tender in which is the case with net contracts. But now there are two industries, one consisting of specialized production companies which face the cost risks and the other being

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specialized marketing companies which face the income risk.
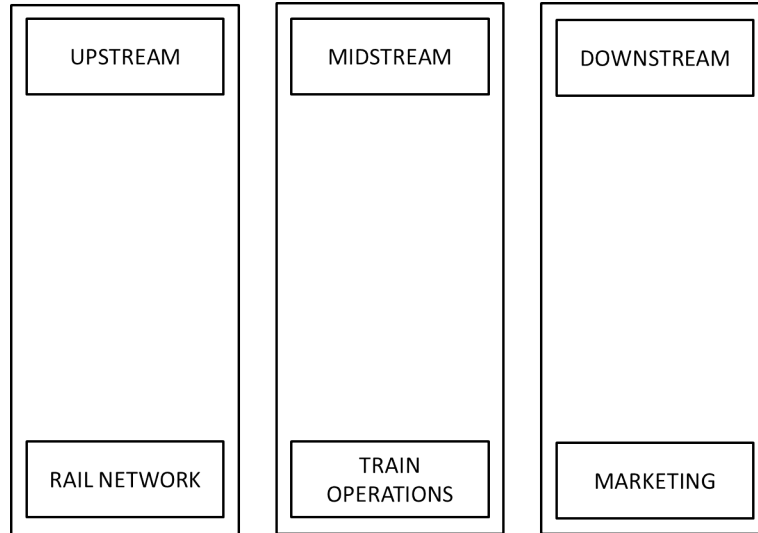
Figure 2.2.2: Separated Downstream Industry
(Source: authors' own illustration)

Provided that the railway network is regulated, there is no rational reason to integrate these three parts of the industry into one company. Otherwise, if the railway network is not regulated, the train operating company is in a classical hold-up situation. This is due to the fact that the network operating company can prevent access to the rail network or impose monopolistic track access charges on the train operating company. The complexity of a wheel-rail-system leads to high level specific requirements which increase the specificity and as a result the uncertainty of the investments for both operators.

Thus there should be only one way without regulation to avoid this hold-up situation. Both parts of the value chain have to be integrated into one company. If most of the network investments are sunk the network operator has to integrate the different levels of the value chain by vertical forward integration. This may be the reason why since the beginning of rail transport there still been existing integrated train and network operating companies.

If the operation of the network is regulated and there exists a secure legal framework the company boundaries of an integrated train and network op-

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erating company are no longer optimal. With price regulation, open access and a regulated framework for system integration the specificity and uncertainty of investments for both companies are low. Therefore it is possible to have a vertically separated industry with companies concentrated on the core business.

The same applies to the situation between the marketing company and the train operating company. Basically, the specificity and the uncertainty of the investments for the two companies together are very high. It is therefore reasonable to assume that in an unregulated market a vertical integration of the two companies would be useful to avoid a hold-up situation. Therefore from the perspective of transaction cost theory, it was quite reasonable to have an integrated state owned network, train and marketing operating company in the market.

Due to the fact that the contractee stipulates the scope of services for the train operating company, the specificity and uncertainty of the investments for train operating and marketing companies are low.

In summary, from the perspective of transaction cost theory the vertical integration of different levels of the value chain is not necessary and a market solution is possible.

Nevertheless it is necessary that the contracts between the contractee and the contractors on the different levels of value chain are complete for the horizontal relations between contractor and contractee and the vertical relations between the contractors.

Chapter 3

General Auction Characteristics

3.1   Market Organization

The main difference between a rail transport tender as compared to a regular auction are the unprofitable operations, so the train operating company does not have to pay for the unprofitable concession. Instead, it gets a financial compensation for the services. Thus, the company requiring the lowest subsidies, i.e. the company with the highest bid in the auction, will attract and provide the advertised service for a fixed period.

Every year especially the German federal states offer a lot of such tenders. So there are two levels of competition. The first level is the local competition for one regional monopolistic aftermarket. Every regional aftermarket is a sub-network of the whole rail-network. So every outcome of an auction changes the state of the national premarket. Or if a train operating company wins an auction, the train operating company wins the regional aftermarket for transportation services and maybe achieve a stronger position in the national premarket. Therefore on the regional level there exists competition in the consumer market, while on the national level there is competition for local monopolistic aftermarkets for train operations.

With regard to the fact that local aftermarkets are embedded in a greater network, there are effects of adjacencies of other aftermarkets or some be-

havioural strategic effects. This thesis is focuses on the effects of the form of auctioning. The analysis is independent of the economic appeal insofar as there is the general assumption that all aftermarkets have a payoff below zero and thus have to be subsidized.

3.2   Object Design

A first special issue within the topic of how to auction an aftermarket is the difference between gross and net contracts. These are two different designs of the tendered objects. Reconsider that in the case of 'gross contracts' the train operating company is only responsible for train operations. In the case of 'net contracts' the train operating company is also responsible for the selling and distribution of tickets. Therefore 'gross contracts' mean that the train operating company faces the cost risk and the public contractee faces the income risk. Otherwise in the case of 'net contracts' the transport service provider faces both cost and income risks.

Secondly there is the difference between publicly and privately financed rolling-stock. In the first case, the public contractee uses his advantage[1] on the financial markets and finances the rolling-stock less expensively than the private operator. This may lead to different expectations about revenues. So the valuation would be more uncertain. Therefore it is interesting to explore differences in valuation between auctions with net contracts and auctions with gross contracts.

We assume that the contractee has the option to choose between four different object designs (gross contract with privately financed rolling-stock, gross contract with publicly financed rolling stock, net contract with privately financed rolling-stock and net contract with publicly financed rolling-stock), thus between four different scenarios with four different auction results. Then the train operating company decides to stay out or to stay in and bid something for the license. Furthermore, we assume that the payoff is zero if one train operating company loses the auction or decides for the outside option. Hence in the case of 'stay out' or 'stay in' and losing the auction the train operating company receives a profit of 0 and the contractee has to pay the train operating company nothing. In the case of 'staying in and accepting the bid' the train operating company receives a payoff $x - b$ and the contractee

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[1]A financially stable European country like Austria has a very high solvency. The reason for this is the ability to levy new taxes, if needed.

has to pay B, with B being the public budget for this transport service and x being the value of the object. B consists of b and ψ, with b representing the bid describes above and ψ the missing parts of the contract. The missing parts of the contract are described in Table 3.2.1:

ψ	gross contract	net contract
private rolling-stock	marketing	
public rolling-stock	rolling stock, marketing	rolling stock

Table 3.2.1: Object Design
(Source: authors' own illustration)

Definition 3.2.1. Given gross and net contracts and objects design with publicly financed rolling stock and private rolling stock. There are four different object designs respectively:

Gross contract with publicly financed rolling stock. Denoted by gc

Gross contract with privately rolling stock. Denoted by gcr

Net contract with publicly financed rolling stock. Denoted by nc

Net contract with privately financed rolling stock. Denoted by ncr

For each of these object designs the composition of the public budget is different.

Definition 3.2.2. Given the object designs describes above, there are four different compositions of the public budget:

A budget for gross contract with publicly financed rolling-stock B_{gc} consists of subsidies for the train operating company b_{gc}, revenues from ticket selling w and capital cost of the rolling stock r.

$$B_{gc} = -b_{gc} - \psi_{gc} = -b_{gc} + w - r \qquad (3.2.1)$$

A budget for the gross contract with private rolling-stock B_{gcr} contains subsidies b_{gcr} and the revenues from ticket selling w.

$$B_{gcr} = b_{gcr} + \psi_{gcr} = -b_{gcr} + w \qquad (3.2.2)$$

A budget for the net contract with publicly financed rolling-stock B_{nc} includes subsidies b_{nc} and the capital cost r of the rolling stock.

$$B_{nc} = b_{nc} + \psi_{nc} = -b_{nc} + r \qquad (3.2.3)$$

A budget for the net contract with private rolling-stock B_{ncr} contains the subsidies b_{ncr}.

$$B_{ncr} = -b_{ncr}, \ and \ \psi_{ncr} = 0 \qquad (3.2.4)$$

3.3   Auction Design

If the state has opted for the tender, then again the contractee has two options. The contractee can choose between a quality competition (Beauty Contest) and a price competition. This thesis only examines what it means when if the contractee decides for a competition about subsidies (price competition). In the rail transport industry a beauty contest is called a functional tender. To the author's knowledge there is no example of a pure functional tender in the passenger rail transport industry. To the author's knowledge there were only two instance of this kind of tender in public bus transport in the small city of Elmshorn in the Hamburg Metropolitan Area and in Haarlem in the Netherlands van de Velde et al. (2008).

The tender of a public rail transport concession is a non-cooperative game, where the contractee decides which contract design he will offer. Furthermore the tender is a sealed-bid first-price offer auction. To the author's knowledge there are no open offer auctions or second-price auctions in public rail transport. There is no case in literature where second price sealed bid auction is used in such a tender.

Chapter 4

Assumptions

The aim of the following subsection is to apply to the model the specific characteristics of the public rail transport industry, which were described in sections one and two. We do this by stating the assumptions, explaining the aim of these assumptions and the plausibility of the assumptions in the context of the rail transport industry.

4.1 The Value of the Object is Negative.

In reality all concessions in public transport are not profitable for two reasons: The first reason is production-related and the second reason is of a political nature.

4.1.1 Timetable and Peak Times

Firstly, we know from Subsection 2.2 that a timetable with short intervals is very expensive and only profitable at peak times; and that the state has to subsidize public transport companies to ensure a stable timetable with high reliability.

4.1.2 Public Transport is a political good

Secondly, in Europe there exists a second reason for subsidized public transport. In many European countries rail passengers have become accustomed to low rail fares. These rail passengers are also voters which mean that cost-covering rail fares are politically not feasible. Furthermore, in many European countries the political top priority goes towards enhancing the modal split in public transport by subsidized below-cost rail fares.

4.2 Train Operating Companies are Symmetric.

This means that N different potential train operating companies assign a value X_i to the object which is the maximum of what train operating company i wants to pay for the object. If the N train operating companies are symmetric, they draw their valuation and the corresponding private signal from the same interval. That means that X_i is identical and independently distributed over the interval $[-\infty, \omega]$. Train operating company i knows only its own signal x_i the realization of the random variable X_i. In that case train operating company i will play a strategy $\beta_i : [-\infty, \omega] \to \mathbb{R}_-$.

The aim of this assumption is to make the different train operating companies easily comparable. This assumption is plausible in so far as we know from the introduction that there is an ongoing concentration process in the public transport market. In the beginning of privatization, there was a national incumbent operator almost everywhere and some small local entrepreneurs. With ongoing privatization and concentration between former incumbent operators and private operators, as well as between private operators differences diminish between the potential contractors.

These symmetric train operating companies draw their valuation from an interval which contains up to three different parts of the industry described above. For each part there exists an interval so that:

$$c_i \in [\underline{c}, \overline{c}] \tag{4.2.1}$$

$$w_i \in [\underline{w}, \overline{w}] \tag{4.2.2}$$

$$r_i \in [\underline{r}, \overline{r}] \tag{4.2.3}$$

4.2.1 Cost of Train Operations

The cost of train operations consists of an important fixed cost element and some variable costs of operations dependent on the required amount of seat kilometres and the required amount of train kilometres. From this it follows that there is an important fixed cost element, because the required amount of seat kilometres and the required amount of train kilometres are fixed in the tender document. The train operating companies know before a tender occurs how many seat and train kilometres they have to produce, if they win the tender.

Thus they know the required amount of seat kilometers, but not the realized amount of passenger kilometres. The required amount of train kilometres is the traveled distance of one train

$$train\,kilometres\,(TKM) = traveled\,distance\,of\,one\,train \tag{4.2.4}$$

and the required amount of seat kilometres is the multiplied number of the train capacity and the train kilometres, which is fixed in the tender documents.

$$seat\,kilometres\,(SKM) = train\,kilometres \times train\,capacity \tag{4.2.5}$$

The realized amount of passenger kilometres is the multiplied number of the

passengers and their traveled distance. That means the contractors cannot reduce their capacity if the demand is lower as expected.

$$passenger\,kilometres\,(PKM) = utilisation\,in\,percent \times SKM \quad (4.2.6)$$

If the train operating companies know how many train and seat kilometres they have to produce, there is only uncertainty about their own ability to produce the required amount of train kilometres and train operating company i has the following optimization problem:

$$min\,c_i(train\,kilometres) \quad (4.2.7)$$

4.2.2   Revenues from train operations

The revenues from train operations consist of the realized amount of revenue passenger kilometres which is calculated by the number of revenues paid by the passengers for the travelled distances. Therefore there is uncertainty about the ability to sell tickets and the realized amount of revenue passenger kilometres. Thus there are not only risks about the company's own ability to sell tickets, there are also risks about the expected demand.

$$revenue\,passenger\,kilometres\,(RPK) = PKM \times price\,per\,traveled\,distance$$
$$(4.2.8)$$

Please note there is also a cost function which is a side condition of the revenue function. We know the company which is responsible for marketing has to maximize the revenues if it wants to minimize the cost of marketing i.e. it has to solve the optimization problem is 4.9

$$max\,w_i(RPKM)\,s.t.\,min\,c_i(amount\,of\,customers, ...) \quad (4.2.9)$$

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4.2.3 Capital Cost

The uncertainty about the capital cost is exogenous. Therefore the interval for the symmetric train operating companies is an interval dependent on the intrest rate. The total volume of the capital cost depends on the train capacity and the train kilometres and additionally required quality standards. It is logical and necessary that the capital cost depends on the size of the railcars and that the depreciation depends on the train kilometers. So far the optimization problem of the train finance company is the following:

$$min\, r_i(TKM, Capacity, Quality\, Standards) \qquad (4.2.10)$$

4.2.4 The Sum of Intervals

For each contract design there exists an interval of its own, which is a sum of one, two or three of the intervals describes above. In the case of gross contracts with publicly financed rolling-stock the interval for the symmetric train operating companies is the same as the interval resulting the risk of the rail operations.

$$b_{gc} = c_i \in [\underline{c}, \overline{c}] \qquad (4.2.11)$$
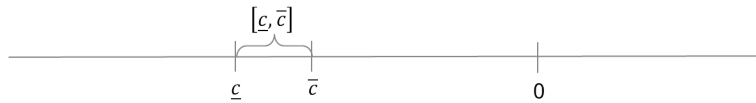

Figure 4.2.1: Gross Contract with Publicly Provided Rolling-Stock
(Source: authors' own illustration)

The interval for the net contract with publicly financed rolling-stock is the sum of the rail operations interval and the revenue interval. Considering the assumption that public transport is not profitable, the net contract interval is less than zero like in Figure 4.2.2.

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$$b_{nc} \in [\underline{c} + \underline{w}, \overline{c} + \overline{w}] \qquad (4.2.12)$$
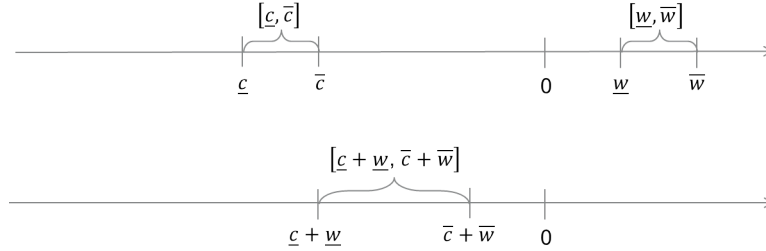
Figure 4.2.2: Net Contract with Publicly Provided Rolling-Stock
(Source: authors' own illustration)

With the same reasoning the interval of the gross contract with privately financed rolling-stock is the sum of the rail operations interval and the capital cost interval and is thus also below zero as illustrated in Figure 4.3.

$$b_{gcr} \in [\underline{c} + \underline{r}, \overline{c} + \overline{r}] \qquad (4.2.13)$$

Figure 4.2.3: Gross Contract with Privately Financed Rolling-Stock
(Source: authors' own illustration)

The net contract with privately financed rolling-stock is the sum of all three intervals and consequently the value of the object is below zero.

$$b_{ncr} \in [\underline{c} + \underline{w} + \underline{r}, \overline{c} + \overline{w} + \overline{r}] \qquad (4.2.14)$$
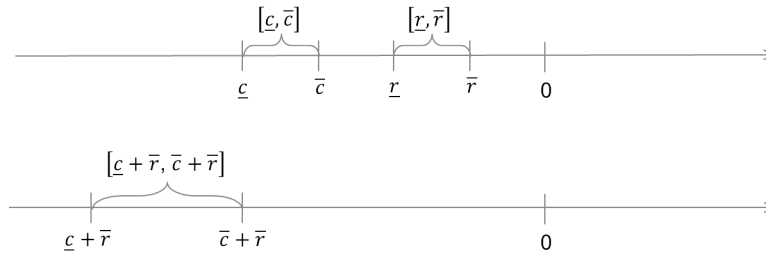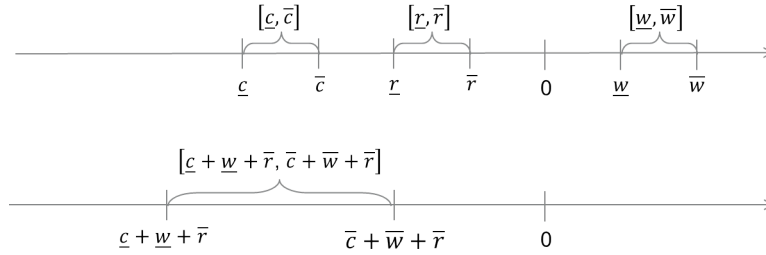
Figure 4.2.4: Net Contract with Privately Financed Rolling-Stock
(Source: authors' own illustration)

4.3 Common Knowledge of Rationality.

The aim of this assumption is market efficiency. It is the most common assumption in game theory and was introduced by Aumann in 1976 Aumann (1976). This is a plausible assumption insofar as we assume that the train operating companies are symmetric and from the same type, they are global player and the concentration process is in advanced progress and time for behavioural strategic bidding is over.

4.4 Bidding is costless.

This is a technical assumption. In general it is not plausible, that bidding in public rail transport is costless. There are costs involved regarding the company's estimation of its own ability to produce rail operations or to preparation of correct offer documents. If we model the cost of bidding as a sunk entry fee which is very small relative to the volume of the concession and there are N symmetric train operating companies with symmetric arbitrarily small sunk entry fees which are negligible, that does not affect the outcome of the tender.

4.5 Train Operating Companies are Risk-Neutral.

The goal of this assumption is to use risk neutral-models, because in that case the effect of risk aversion does not matter. This assumption is for convenience, as the train operating companies are specialized in rail operations. Perhaps some bidders with aggressive growth were risk-neutral in the beginning of rail privatisation so that they suffer of winner's curse during the contract period.

Furthermore, there are some examples of winner's curse in the rail transport industry, for example the Flensburg ExpressLalive und Schmutzler (2008) in Germany, BK Tåg in Sweden and Connex 2003 in the United Kingdom Alexandersson (2009). For an overview of winner's curse in the rail transport industry see Lalive and Schmutzler (2008) Lalive und Schmutzler (2008), Beck (2006)and Andersson (2009) Alexandersson (2009). Whether winner's curse has a critical impact on public rail transport tendering has not exactly empirically proven. But there still exists some examples of winner's curse such that one can assume that train operating companies in public rail transport tenders are risk neutral.

4.6 Train Operating Companies Only Consider the Number of Potential Train Operating Companies and Not the Number of Actively Bidding Train Operating Companies.

The goal of this assumption is to explain why train operating companies consider a strategic effect for participating train operating companies if they bid in a sealed-bid tender. The assumption is highly plausible, because Amaral et al. (2009)Amaral et al. (2009) have shown for the public bus transport market of London that the individual bus operating companies bid according to the number of potential bus operating companies and not to the num-

ber of actively participating bus operating companies. Thus train operating companies know the number of potential train operating companies in the beginning of the tender.

4.7 There are No Synergies between Production and Marketing, because Operational Requirements are Well Defined in the Contract.

The aim of this assumption is to explain why it is possible to divide the downstream part of the public transport industry into a midstream part and a downstream part as already described in section two. This assumption has a strong connection to the assumption about the valuation intervals. The required amount of seat kilometres is fixed in the contract, thus for the rail operations the realized amount of revenue passenger kilometres does not matter. We already know that the rail operator cannot fit his supply to the demand. This implies that there are no advantages of an integrated short-term capacity and yield management like in long-distance rail transport or air transport. Thus there is no necessary connection between rail operations and marketing and both parts can stand alone.

Furthermore we know from section two that there are no synergies between marketing and production. Hence, it is possible to operate both parts of the industry separately with the same efficiency as if they were operated integratedly.

The same is true for rolling-stock. The financing of rolling stock-has no influence on the maintenance or the selling of tickets. If the public entity finances the rolling-stock this does not mean that it also chooses the rolling-stock. In the case of gross contracts, the rail operator chooses rolling stock and the public entity finances the rolling stock.

There are many examples from Germany where a new entrant operates rail

transport and the former incumbent operator DB Regio AG performs the marketing of the rail operations.[1] For example in public bus transport gross contracts are the rule Amaral et al. (2009).

There is already an example from the German Ruhr Area, where the winning train operating company decides which railcars they will use for the train operations, while the public entity VERKEHRSVERBUND RHEIN-RUHR (VRR) finances the railcars.Jasper (2009)

4.8   There Exist a Reservation Price

We know from empirical economic research that private rail operators improve the quality of rail operations and reduce the cost Yvrande-Billon (2006),Amaral et al. (2009). The public inefficiencies are the so-called Leibenstein-X-inefficiencies.Leibenstein (1966) Thus, there is a reservation price for the contractee. If the bid of all train operating companies is lower than the X-inefficiencies, then the contractee will not tender. Because of that there is only one reason that the contractee tender: He hopes that there is an operator who is more efficient in producing public services. In the following $\underline{b}$ denotes the reservation price of the contractee. Suppose all train operating companies know $\underline{b}$.

4.9   There Exist Horizontal Synergies in the Case of Ticket Selling

The purpose of this assumption is to clarify why a direct award or tender of ticket sales can be cheaper for the contractee. Although synergies do no exist between rail operations and marketing, there can exist synergies between the different levels of public transport. In many European countries there exist transport networks with integrated fares for bus and train. These

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[1]e.g. Arriva-Länderbahn Express

fares include transportation by bus and the two lowest levels of rail transport. Moreover, in most European countries there exists one sales system for all four levels of transport.

4.10 Number of Potential Train Operating Companies

In the following analysis we can distinguish four different scenarios. Each of these scenarios or contracts requires different skills from the train operating companies. Therefore the number of potential train operating companies depends on the necessary skills. Given the value-added segments described above, we know that from the perspective of a train operating company the net contract is an extension of the gross contract and a contract with privately financed rolling-stock is an extension of a contract with publicly financed rolling-stock.

Basically, train operating companies must be able to handle rail transport. Without this basic ability, a company cannot participate in a public rail transport tender. All other types of contracts such as the gross contract with publicly financed rolling-stock are extensions of this basic capability. Winning train operating companies have to be sufficiently capitalized to finance their own rolling stock.

In the case of net contracts with publicly financed rolling-stock the potential train operating companies have to be able to operate rail services and to sell tickets. These companies must have expertise in marketing and production. Thus the last two scenarios are extensions of the simple gross contract scenario with publicly financed rolling-stock. That means that if a company can bid for one of the two contracts, this company can also bid for the simple gross contract.

In the last case in which a potential train operating company controls production and marketing and furthermore is sufficiently capitalized, it can bid for all types of contracts.

We know that there are two core competencies, train operation and marketing and one property, namely excellent credit rating, to financing the railcars. Suppose all companies which are able to operate trains are in set S_c, all companies which are able to sell tickets are in the set S_w and all companies

with an excellent credit rating are in set S_r. Then follow from subsection 3.2 that N_{gc} are the counted elements (companies) of set S_c. N_{nc} are the counted elements of intersection $S_c \cap S_w$, and equivalently, N_{gcr} are the elements of intersection $S_c \cap S_r$; and the number of the potential bidders which are able to fulfill a net contract with privately financed railcars are the elements of the intersection $S_c \cap S_w \cap S_r$. So far, if we have no information about the distribution of the efficient train operating companies among the three different sets, we have to assume that every intersection acts like a filter and the following statements are true:

$$(S_c \cap S_w \cap S_r) \subseteq (S_c \cap S_w) \subseteq S_c \qquad (4.10.1)$$

$$(S_c \cap S_w \cap S_r) \subseteq (S_c \cap S_r) \subseteq S_c \qquad (4.10.2)$$
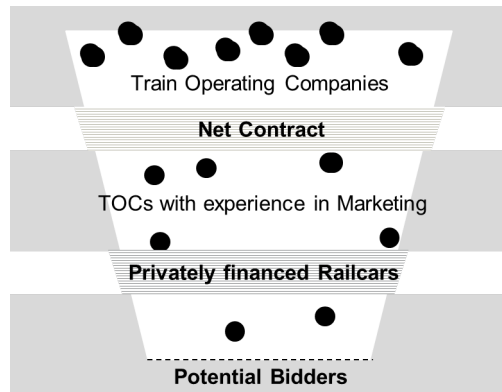
Figure 4.10.1: Filter 1
(Source: authors' own illustration)

Statement 4.10.1 is illustrated in Figure 4.10.1 and statement 4.10.2 is illustrated in Figure 4.10.2. With every extension of the gross contract with publicly financed rolling-stock the number of potential bidders is diminishing.
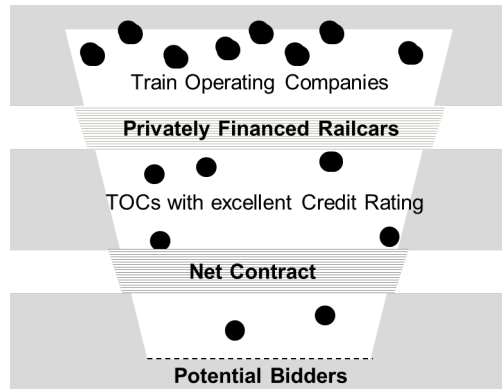
Figure 4.10.2: Filter 2
(Source: authors' own illustration)

Consequently the number of potential train operating companies will be higher if the contractee offers contracts where fewer qualifications are required. Suppose N is the number of potential tender participants or the counted elements in each set or intersection of sets, then the following statements are true

$$N_{gc} \geq N_{nc} \geq N_{ncr} \qquad (4.10.3)$$

$$N_{gc} \geq N_{gcr} \geq N_{ncr} \qquad (4.10.4)$$

Chapter 5

Theoretical Benchmark

In this section an answer to the first research question is given. The goal of this section is to determine which object design is optimal for the contractee. For the benchmark the market structure of the aftermarket has no influence on the auction. The idea of this contract design is to show which contract design minimizes public spending in a market with symmetric train operating companies.

5.1 The Contractee Prefers Public Financed Rolling-Stock

According to Kirchner (2011), especially in the advanced liberalized countries of Western Europe [1], the privatization of public rail transport has progressed. We know that in these countries, public bodies generally have a much higher creditworthiness than private companies. Taking this circumstance into account, we assume that the public sector has massive financial benefits.

This means that a private company would have to face much higher interests, if it wanted to finance the rolling-stock than the public sector. Therefore it

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[1]Sweden, Great Britain, Germany, Denmark, Netherlands and Austria.

is reasonable that the contractee will always opt for contracts with publicly financed rolling stock.

Furthermore, we know from subsection 4.2.3 that capital costs depends on the size and the quality standards of the railcar and the depreciation depends on the required amount of train kilometers. While the interest rate is exogenous, the capital cost depends on determinants which are under the control of the contractee.

But that does not mean that the winning bidder has to run the services with publicly chosen railcars. Such models exist with publicly owned railcar companies. But there exist also more efficient models. So there is a model in the Rhein-Ruhr Metropolitan area where each party takes over the tasks they can perform best and most economically.Jasper (2009)

While the contractee buys and finances the railcars, the train operating company chooses and orders the railcars after winning the contract. During the contract period, the train operating company has to ensure the maintenance. As the train operating company uses the railcars, it can quickly identify faults and also has to control and ensure the preservation of the quality of the railcars.

The proposed funding leads to cost reductions for the public contractee. It also means that each party takes over the tasks they can perform best and most economically.Jasper (2009)

5.2 Setup

We can consider that every player wants to maximize

$$\pi_i = \begin{cases} x_i - b_i & if \quad b_i > max_{-i}b_{-i} \\ 0 & if \quad b_i < max_{-i}b_{-i} \end{cases} \qquad (5.2.1)$$

where x_i is different for the four different contracts so that π_i is different for the four different scenarios. Player i receives $x_i - b_i$ if his bid is the highest bid of $N - 1$ bids (e.g. $b_i > max_{-i}b_{-i}$), otherwise he receives 0.

The tender of the subsidized services is a first-price auction in the southwest quadrant of the bid-valuation diagram like in Figure 5.2.1. Suppose β is the increasing and differentiable symmetric equilibrium bidding strategy[2] and ω is the signal of the value. So the equilibrium for a sealed bid first-price offer auction is with small differences exactly the same as in a classical first price auction. The sole difference is the role of 0 as a bid. In a classical sealed-bid first-price auction 0 is the same like stay out, while in a sealed bid first-price offer auction 0 is a bid, which is very attractive for the contractee.

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[2]The linear function is chosen for simplicity. Of course others are also possible.
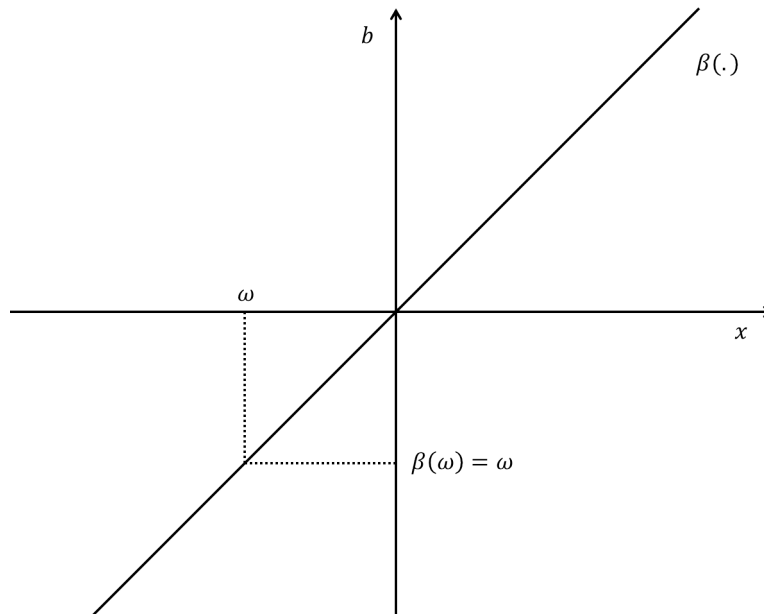
Figure 5.2.1: Bidding Function
(Source: authors' own illustration)

Furthermore 0 is important in order to calculate the equilibrium in a classical sealed-bid first-price auction. This is not possible in an offer auction. Therefore it is useful to introduce a reservation price $\underline{b}$. Suppose that the contractee will never accept a bid below $\underline{b}$, then $\underline{b}$ can accomplish the same technical function as 0 in a classical first-price auction. The following formulation of the equilibrium in a first-price auction is very close to the formulation and notation of a first-price auction equilibrium in Krishna (2010).

5.3 Sealed-Bid First-Price Private-Value Offer Auction

In a sealed-bid first price private-value offer auction every train operating company has a private valuation. Thus there is no interdependence between two train operating companies' valuations and the signals which the train operating companies receive are not affiliated. Thus every train operating company has a subjective, independent and exogenously determined value of its own and has no information about private value of other train operating companies.

5.3.1 The Equilibrium Strategy of the Winning Operator

Suppose ω_i is the independent and exogenous valuation of player i and π_i are the profits which player i can receive if he wins the auction. If $b_i = \omega_i$ then $\pi_i = 0$, because player i is indifferent with regard to offering or not offering he will never bid more than ω_i.[3] This means that bidding lower calculations of subsidies than are required to operate the rail services with zero profits, is not a profitable strategy.

To derive this equilibrium, suppose that independently of the object design $N \geq 2$ train operating companies follow a symmetric and differentiable equilibrium strategy $\beta^* \equiv \beta$. Furthermore train operating company i receives a non affiliated signal about operations x_i. This signal is an estimate of the cost of the operations and therefore a realization of a random variable X_i. After it has received the signal, it can calculate its optimal bid b_i and bids b_i. Krishna (2010)

In the next step one wants to calculate the optimal strategy of player 1 which is called β. Suppose all train operating companies $j \neq i$ follow a symmetric

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[3]Please note that the valuation for the train operating company has a different sign than the classical first-price auction, which means if the valuation increases in absolute numbers, player i needs more subsidies to operate the services.

and differentiable equilibrium bidding strategy. Train operating company i wins the tender, whenever train operating company i submit the highest bid[4], that is when the maximum bid of all the other train operating companies is lower than the bid of train operating company i $(max_j\beta(X_i) < b)$ and since $\beta(\underline{b}) = \underline{b}$, where $\underline{b}$ is the reservation price Krishna (2010):

$$\beta^*(x) = \frac{1}{G(x)} \int_{\underline{b}}^{x} yg(y)dy = E[Y_1 \mid Y_1 < x] \qquad (5.3.1)$$

Where $x - \beta^*(x)$ is the mark-up on the offer, suppose $x - \beta^*(x) = \alpha x$, then α is the mark-up coefficient. Every mark-up coefficient smaller than one increases the amount of subsidies and makes the operating activities profitable. It is the target of the train operating company to increase the mark-up to gain more profits. On the other hand the contractee wants to decrease the mark-up to minimize public spending. The train operating company can increases the profits if the number of potential train operating companies is small and therefore the probability to win the tender is high. If the probability to win the tender is small, then the train operating company has to decrease the mark-up to win the tender.

5.3.1.1 The mark-up depends on N

Vickrey (1961) has shown, that it is possible to rewrite the equilibrium bidding strategy as

$$\beta^*(x) = x - \int_{\underline{b}}^{x} \frac{G(y)}{G(x)} dy \qquad (5.3.2)$$

Where $\frac{G(y)}{G(x)} = \left[\frac{F(y)}{F(x)}\right]^{N-1}$ is the degree of shading. That means if the number of competitive train operating companies increases, the chances of winning

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[4]lowest offer

the auction are diminished, the mark-up coefficient converges to one and the first-price auction mark-up decreases to zero.

In a classical first-price auction the degree of shading ensures that the equilibrium winning bid is below the valuation. The difference between bid and valuation is the profit of the winning train operating company. A greater degree of shading leads to lower bids and higher profits. The optimal degree of shading depends on the number of potential Train Operating Companies. As the number of potential train operating companies increases, the profits of the winning train operating company converge to zero. In summary, with a decreasing number of potential train operating companies the profits increase of the train operating company with the highest bid.

In the case of tenders this means that the degree of shading is a mark-up on the offer. This mark-up increases when the number of train operating companies is decreasing and it goes to zero as the number of train operating companies is increasing.

We know from section three that the number of potential train operating companies depends on the chosen object design. That means that the mark-up in the case of gross contracts is relatively larger than in the case of net contracts. With the same reasoning the mark-up is larger in the case of publicly financed rolling stock than in the case of privately funded rolling stock.

5.3.2 The Contractee's Decision.

Suppose that the risk-neutral train operating companies follow the equilibrium bidding strategy $\beta^*(x)$ derived above independently of the object design. Then the contractee has to decide which object design to choose in order to maximize the bids. In other words, the contractee wants to minimize the mark-up coefficient. Therefore the contractee has to find the smallest budget, which allows him to operate the public service.

Consider again the difference between privately and publicly financed rolling stock. Even under the assumption that private operators have the same

finance standing as the public sector, it may not be effective for the contractee to finance the rolling-stock privately, because if the contractee commissions a private financier, this private financier would still ask for a mark-up to make profits.

5.3.2.1 The decision between gross and net contracts

Therefore we consider only the choice between gross and net contracts with publicly financed rolling-stock. Now there are two different object designs and one has to define two different signals x_i. Both signals are estimates of the real operational cost and revenues.

We know both contracts consist maximally of two different independent parts (production, marketing). Because there are no synergies between the two parts, it is possible to formulate the signal for one contract as the sum of the signals for each part of the contract. The signal is a valuation drawn from the sum of intervals as described above. Now the contractee has to select the method according to which he has the fewest expenses. In the following we have to compare the budgets for gross and net contracts.

First of all we have to formulate the payoff functions and the expected payoff functions for both scenarios. Therefore we have to define in Definition 5.1 the different signals.

Definition 5.3.1. Given well-formulated tender documents and that the assumptions described in section three hold, then the estimate of the private and independent cost of the whole operation for all players $i = 1, .., N$ is defined as $x_i(c_i)$ and the private and independent estimate of the private and independent revenues from ticket selling for all players $i = 1, ..., N$ is defined as $x_i(w_i)$.

We know:

$$x_i(c_i) \in [\underline{c}, \overline{c}] \tag{5.3.3}$$

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$$x_i(c_i) + x_i(w_i) \in [\underline{c} + \underline{w}, \overline{c} + \overline{w}] \qquad (5.3.4)$$

The cost and the revenues are not certain, because nobody knows the realized amount of passenger kilometres at the beginning of the tender. And we have to assume that there is uncertainty with regard to the firms knowledge concerning production and marketing respectively. The capital costs are uncertain, too. Therefore the needed subsidies required for the contracts and the payments for the sales contracts are residual quantities.

By assumption the profit functions of each object design are additive functions. No synergies between marketing and production and respectively, between selling and operations are realizable. That means the combination of two or three parts of the industry in one contract and in this way in one firm does not have any effect on for the cost structure of marketing and production.

Definition 5.3.2. Given the above formulated assumptions there are two different payoff functions for the two different object designs with publicly financed capital.

π_i	gross contract	net contract
public capital	$\beta^* - c_i$	$w_i + \beta^* - c_i$

Table 5.3.1: Payoff Functions
(Source: authors' own illustration)

where

c_i is the independent value of the operational cost,

w_i is the independent value of the revenues

β^* is the equilibrium bidding strategy

Before the auction occurs, the corresponding valuations are unknown and can only be estimated from the interval described in section three. Thus every contract is a random variable and accordingly has an expected value and variance.

Definition 5.3.3. Given the two different signals x_i from Definition 5.1., then we can define the two contract designs as follows:

X_i	gross contract	net contract
public rolling-stock	$x_i(c_i)$	$x_i(c_i) + x_i(w_i)$

Table 5.3.2: Signals
(Source: authors' own illustration)

1. $x_i(c_i)$ is the private and independent estimate of the gross contract with publicly financed rolling-stock for all players i

2. $x_i(c_i) + x_i(w_i)$ is the private and independent estimate of the net contract with publicly financed-rolling stock for all players i

There is an expected value μ for every estimator of the subsidies needed. In the assumption which does not take into account synergies, these estimators are additive and therefore the expected value of the operations is the sum of the components. This leads to the following results:

	gross contract	net contract
public rolling-stock	μ_c	$\mu_c + \mu_w$

Table 5.3.3: Estimator
(Source: authors' own illustration)

Where are μ_c, μ_w are the expected values of the uncertain cost, revenues and capital cost.

where

$$E[x_i(c_i)] = \mu_c < 0 \tag{5.3.5}$$

$$E[x_i(c_i, w_i)] = E[x_i(c_i)] + E[x_i(w_i)] = \mu_c + \mu_w < 0 \tag{5.3.6}$$

$$0 > \mu_c + \mu_w > \mu_c \tag{5.3.7}$$

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In the case of net contracts a third party has to sell the tickets and is responsible for the marketing part in the industry. In reality this is often the incumbent operator or sometimes the contractee himself.

Assuming that the in-house solution for marketing in the case of gross contracts can be made with the same efficiency as in the case of net contracts, it is easy to show that the contractee would prefer the gross contract. We know in the case of the net contract, that the number of potential train operating companies would be smaller and thus the possible mark-up on railway operations and marketing would be higher. Thus, it is clear that if the in-house solution could work with the same or a higher efficiency than the outsourcing solution, the in-house solution is more favourable to the contracting authority.

But what happens if the in-house solution produces less efficiency than the outsourced solution? Then two effects collide.

Firstly there is a lack of efficiency, respectively the in-house producer is too expensive. If this is the case depends on third-party ticket sellers and is exogenous in this model.

But there is also an a contrary mark-up of the winning train operating company. The mark-up of the winning train operating company is a mark-up on the cost of rail operations and lower payments for the ticket revenues. This means that the mark-up on the train operating cost is higher, because there are fewer potential contractors available. Accordingly, the mark-up in net contracts contains three parts. If the number of potential train operating companies is smaller in the case of net contracts, then the mark-up coefficient is smaller as the mark-up coefficient in the case of gross contracts. Therefore the mark-up on the train operating cost consists of the same mark-up as in the case of gross contracts and the difference net and gross contracts. That means the extension of the contract (net contract) increases the mark-up on operating cost. Furthermore there is the mark-up on the revenue payments.

In summary the third-party seller in the case of gross contracts has to be more less efficient as the winning Train Operating Company is more expensive in

the case of net contracts, if the contractee should prefer net contracts.

5.3.3 Intermediate Results

The benchmark analysis in the private value setting delivers two key results. Both results are based on the potential competition, which is determined by the scope of the contract.

Firstly, a contractee will never prefer an agreement with privately funded rolling-stock. Rather, he will decide on the basis of the expected increased competition for contracts with public rolling-stock.

Secondly, the profitability of the net contract is limited for two reasons: The profitability is limited by the potential synergies between different levels of transport and by the effects of a contract extension (net contract). Through the extension of the contract the potential competition also decreases. The current ticket selling company has to be considerably less efficient than the train operating company for a net contract so that the contractee prefers the net contract.

This is especially important, because there is not only the additional mark-up on earnings, there is also an additional mark-up on the operational cost. Since operating costs are much higher than the expected revenue this mark-up is not negligible.

In a sealed-bid first price private-value offer auction every train operating company has a private valuation. Thus there is no interdependence between two train operating companies' valuations and the signals which the train operating companies receive are not affiliated. Thus every Train Operating Companies has an own subjective, independent and exogenously determined value and has no information about other Train Operating Companies private value.

There are many examples from Germany where a new entrant operates the rail transport and the former incumbent operator DB Regio AG has to perform the marketing of the rail operations. Reconsider that it is plausible

that the in-house or the tender solution for marketing in the case of gross contracts can be made with the same efficiency is plausible. In this case it is easy to show that the contractee would prefer a gross contract instead of a net contract. For the net contract, we know that the number of potential train operating companies would be smaller and thus the possible mark-up on railway operations and marketing would be higher. Thus, it is clear that if the in-house or the tender solution could be realized with the same or a higher efficiency than the outsourcing solution, it is more favourable for the contracting authority to choose the gross contract.

Chapter 6

Contestability

We already know, that the object design minimizing public spending is the gross contract with publicly financed rolling-stock. To provide an answer to the second research question we have to analyze the impact of the object design on the contestability of the bidder market. Baumol (1982) introduced the idea of contestable markets. The contestability of markets is described by three main features:

1. No entry/exit barriers

2. No sunk cost

3. Access to the same level of technology/human capital

As already mentioned in section two, there are no obvious entry or exit barriers. Indeed there are some hidden entry barriers dependent on the object design. It is trivial to see that in a case of asymmetric bidders a net contract with privately financed railcars and a state-owned incumbent operator has a significant advantage. We know from section five, that in the case of symmetric train operating companies the given auction design is efficient and that the gross contract with publicly financed rolling stock is the object design with the highest number of potential bidders.

From section two we know also, that the investment cost of the train operating companies is not sunk and access to the same level of technology is

not prevented for the whole industry. Consequently, access to the same level of technology is independent of the object design so that the contestability of the market only depends on the possible entry barriers through pooled concessions.

In reality perfect contestable markets do not exists. There is always a possibility to prevent access. One possibility to prevent access is to extend the contracts with further value-added steps. We already know from section two that there are two relevant markets, one for train operations and one for marketing. Therefore a pooling of both relevant markets into one concession ceils an artificial entry barrier into the market. This entry barrier reduces the number of potential bidders. Therefore the degree of competition is reduced due to the decreasing number of potential bidders so that the mark-up on the offers increases.

It is possible to show that in a private value setting the bidder with the highest valuation of the tendered object wins the tender. Because the private-value first-price auction has symmetric and increasing equilibria, the bidder with the highest signal among all the bidders is the winning bidder so that the most efficient bidder wins the tender independent of the auction design.

If we have symmetric bidders in each market, we have to analyze the efficiency of the different object designs. From subsection 5.1 we know that the auction design is independent of the object design efficient, because the players with the highest signals are the bidders with the highest valuation of the object. So far we can argue that the players which win a tender with gross contracts are the most efficient companies to operate trains. Analogously we can argue that companies which win a tender with net contracts are the most efficient companies in train operating and marketing.

6.1   Train Operations

We know from subsection 4.10 that the extension of the pure train operating contract works like a filter and reduces the number of potential bidders. That

means we have no information about the distribution of the competencies among the potential bidders. Furthermore we have to take into account the probability decreases that the most efficient bidder in other words the company with the highest value participates and wins the tender, if the volume of the contracts increases.

6.2 Financing railcars

According to the findings in subsection 5.1, it is reasonable that the contractee will always opt for contracts with publicly financed rolling-stock. because a public body in Western Europe has a better credit rating than a private company. As a consequence, public bodies are the most efficient railcar financiers. It is not possible to find a company with a better credit rating than a public authority.

Let μ_w^* be the expected value of the best credit rated entity. In that case, the contractee has this rating and gets this most efficient value.

6.3 Marketing

Reconsidering subsection 3.3, there are no vertical synergies between train operations and marketing. Furthermore we know from subsection 3.4 that the number of companies which can participate in a tender with net contracts are smaller than or equal to the number of companies which can sell tickets. Like in the previous case of train operations the intersection of the two sets works like a filter. This filter reduces the number of potential bidders. With the same reasoning as before the following statement is true

$$(S_c \cap S_w \cap S_r) \subseteq (S_c \cap S_w) \subseteq S_w \qquad (6.3.1)$$

As a consequence it is more likely that the most efficient player will be commissioned to be responsible for marketing, if the contractee does not tender

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train operations and marketing in an integrated manner.

Chapter 7

Summary and Conclusion

The starting point of this master thesis was the ongoing concentration process in the bidder market for public rail transport. In this context, it was the goal to find a theoretically optimal object design, which minimizes public spending and sustains a competitive bidder market in the rail passenger transport industry.

The rail passenger transport industry includes three value-added steps. We have seen that a separation of the different value-added steps is possible, because the rail network is regulated and the local transport services are tendered by complete contracts.

The nucleus of each tender is the value-added step production (the object design being a gross contract with publicly financed rolling-stock). An extension of this contract means the integration of two value-added steps or the value-added step production and the ability to finance railcars. We have shown that any extension of this core contract design reduces the number of potential bidders.

As a first-price auction is common in Europe, the offered price depends on the number of bidders. With an increasing number of bidders the likelihood decreases that a bidder is the bidder with the highest valuation. In order to win, the bidder has to bid a higher price with a lower mark-up on his valuation.

The probability that one's valuation is the highest valuation of the concession increases when the number of potential bidders decreases. Therefore, the integrated value chain of multiple value-added steps leads to higher prices in the bidder market.

If the contractee has an excellent credit rating, the contractee should finance the rolling stock. Otherwise the contractee will indirectly carry the risk premium of the train operating company.

Given the assumptions made, there is a theoretically very clear answer to the first research question. The boundaries of the optimal object design are the same as the boundaries of the value-added step production and both parties take over the tasks they can perform best and most economically. Thus the value-added step production should be tendered as a gross contract with publicly financed rolling stock.

The second research question can also be answered unequivocally. Because of the proven efficiency of the auction design theory, the contestability of the market is independent of the auction design. By extending the concession to provide additional value-added steps, the number of potential bidders decreases. There is no guarantee that the most efficient bidder for one value-added step has all qualifications which are required to run the concession. That is why only a gross contract with publicly financed rolling-stock guarantees that the most efficient train operating company wins the auction.

The integration of more than one value-added step into one contract reduces the number of potential train operating company on a group of vertically integrated Train Operating Companies. Thus the market for train operations is not contestable for train operating companies without the required experience to run all value-added steps.

From the results of the theoretical benchmark it can be concluded that the transport authorities will only get a sustainable and competitive bidder market with economically satisfactory results, when they separate the value chain into separated bidder markets for production and marketing.

The use of the public sector's funding advantage should be self-evident. The

contractee has to choose an object design where both parties are able to take over the tasks they can perform best and most economically.

The contractees have to act contrary to the increasing concentration processes in the passenger rail transport industry. They have to win new bidders from related industries like freight operating companies or leisure and travel companies. They will only succeed in doing so, if they individually tender the separated value-added steps. A freight operating company may serve a gross contract well, but has no experience in marketing and, vice versa, a leisure and travel company has the necessary experience for sales and marketing, but certainly has no experience in the operation of railcars.

The still form of integrated concessions with marketing and production is essentially a relic of the former state monopolies. We have seen that the mutual dependencies do not exist anymore. If the contractees want to achieve satisfactory results and prices, they have to develop methods and designs to gain new potential bidders in sufficient numbers. Therefore the transport authorities have to adopt the structures of the vertically integrated industry and they have to break new ground.

Bibliography

Alexandersson, G. (2009). 'Rail Privatization and Competitive Tendering in Europe.' *Built Environment*, Vol. 35(1), p. 43–58.

Amaral, M., Suassier, S. und Yvandre-Billon, A. (2009). 'Auction procedures and competition in public services: The case of urban public transport in France and London.' *Utilities Policy*, Vol. 17, p. 166–175.

Aumann, R.J. (1976). 'Agreeing to disagree.' *Annals of Statistics*, Vol. 4(6), p. 1236–1239.

Baumol, W.J. (1982). 'Contestable Markets: An Uprising in the Theory of Industry Structure.' *American Economic Review*, Vol. 72, p. 1–15.

Beck, A. (2006). 'Der Fluch des Gewinners.' *Der Nahverkehr*, (4), p. 29–33.

Jasper, U. (2009). 'Neue Modelle fuer Fahrzeugfinanzierung.' In *Kostenoptimierung im Schienenverkehr: LCC-RAM(S) Engineering*, 52, p. 62–65. Oesterreichischer Verband fuer Elektrotechnik, Oesterreichischer Verband fuer Elektrotechnik, Vienna.

Kirchner, C. (2011). 'Liberalisierungsindex Bahn 2011: Marktoeffnung: Eisenbahnmaerkte der Mitgliedstaaten der Europaeischen Union, der Schweiz und Norwegens im Vergleich.' scientific report 4, IBM Global Business Services, Brussels.

Krishna, V. (2010). *Auction Theory*. Academic Press, San Diego.

Lalive, R. und Schmutzler, A. (2008). 'Entry in Liberalized Railway Markets: The German Experience.' *Review of Network Economics*, Vol. 7(1), p. 37–52.

Leibenstein, H. (1966). 'Efficiency vs. "X-Efficiency".' *The American Economic Review*, Vol. 56(3), p. 392–415.

van de Velde, D., Beck, A., van Elburg, J.C. et al. (2008). 'Contracting in urban public transport.' scientific report, EC DG TREN, Brussels.

Vickrey, W. (1961). 'Counterspeculation, Auctions, and Competitive Sealed Tenders.' *The Journal of Finance,*, Vol. 16(1), p. 8–37.

Yvrande-Billon, A. (2006). 'The attribution process of delegation contracts in French urban public transport sector: Why competitive bidding is a myth.' *Annals of Public and Cooperative Economics*, Vol. 77(4), p. 453–478.

Abstract

The starting point of this master thesis is the ongoing concentration process in the bidder market for public rail transport. Today, the main challenge of the orderers of the regional passenger rail transport is to save a sustainable and contestable market environment. This thesis is the first attempt to provide a theoretical prediction and a theoretical benchmark for the different object designs in a public rail transport tender.

The central idea of this thesis is to find what object design is optimal to auction while minimizing public spending on transport services and at the same time sustaining a competitive and contestable market environment. Thus the research questions are: Which object design minimizes public spending? And which object design makes a tender more contestable?

The idea is to combine modern microeconomic theory and applied economic research. Therefore standard auction and game theory are used for predicting and benchmarking an outcome of the different object designs. From the results of the theoretical benchmark it can be concluded that the transport authorities will only get a sustainable and competitive bidder market with economically satisfactory results, when they separate the value chain into separated bidder markets for production and marketing.

Zusammenfassung

Der Ausgangspunkt dieser Magisterarbeit ist der anhaltende Konzentrationsprozess im Bietermarkt für den öffentlichen Schienenpersonennahverkehr. Die größte Herausforderung für die Besteller ist heute die Sicherung eines nachhaltigen und bestreitbaren Bietermarkts für den Schienenpersonennahverkehr. Diese Arbeit ist der erste Versuch, eine theoretische Vorhersage und ein Benchmark für die verschiedenen Objekttypen Designs bieten in einer öffentlichen Schienenverkehr ausgeschrieben.

Die zentrale Idee dieser Arbeit ist es, das optimale Objekt-Design zu finden welches bei gleichzeitiger Minimierung der öffentlichen Ausgaben für Verkehrsdienstleistungen ein wettbewerbsfähiges und bestreitbares Marktumfeld sicher. So sind die Fragestellungen: Welches Objekt-Design minimiert die öffentlichen Ausgaben? Und welches Objekt Design macht eine Ausschreibung bestreitbarer?

Die Idee ist es, moderne mikroökonomische Theorie und angewandte Wirtschaftsforschung zu kombinieren. Deshalb wird die Auktionstheorie und Spieltheorie für die Vorhersage und das Benchmarking der Ergebnisse der unterschiedlichen Objekt-Designs verwendet. Aus den Ergebnissen der theoretischen Benchmarks kann der Schluss gezogen werde, dass die Verkehrsbehörden nur dann einen nachhaltigen und wettbewerbsfähigen Bietermarkt mit wirtschaftlich befriedigende Ergebnisse erhalten, wenn sie die Wertschöpfungskette in getrennte Bietermärkte für Produktion und Vermarktung teilen.

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