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Research paper

# The impact of 'competition for the market' regulatory designs on intercity bus prices

Javier Asensio [a,b,*], Anna Matas [a,b]

[a] Department of Applied Economics Universitat Autònoma de Barcelona (UAB), 08193, Bellaterra, Barcelona, Spain
[b] Institut d'Economia de Barcelona (IEB), c/ John Maynard Keynes 1-11, 08034, Barcelona, Spain

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ABSTRACT

Spain regulates its intercity bus market by means of a 'competition for the market' mechanism, whose design has been modified several times in the last years. This implies that current services are operated under contracts whose conditions are heterogeneous. We take advantage of such fact to empirically measure the impact that regulatory designs may have on fares paid by the users. Controlling for the different determinant of bus prices at route level the results show very large differences between routes whose contracts were awarded under relatively open conditions compared to regionally regulated routes or old contracts whose concessions were extended in 1987 and have not been retendered since then. The observed difference between the cheapest and the most expensive services is to a great extent explained by the difference in the regulatory designs used to award each contract.

## 1. Introduction

Different European countries have decided to liberalise their intercity bus markets. Following the UK experience in the 1980s, countries such as Sweden (1998), Norway (2003), Germany (2013), Italy (2014), France (2015) or Portugal (2019) have allowed for the entry of new operators who can compete with each other or the incumbents in the market.[1] In Spain, on the contrary, such entry is strictly limited, and competition takes place 'for the market', as firms need to bid in order to win a contract with the public sector which specifies the services to be provided.

However, there are substantial regulatory differences among routes within Spain. Not only are intra- and inter-regional services subject to different norms, but the latter's regulations have experienced frequent changes in the recent past. This implies that the conditions under which current services are operated may be very different, as they depend on the regulatory regimes under which each contract was awarded. One route may have been awarded under regulatory rules that gave very little importance to prices, or which favoured the incumbent operator, while other regulatory regimes may have provided more incentives to bidding by firms (such as supressing unnecessary requirements to participate), or promoted more aggressive price offers by participating firms.

In practice, substantial price differences per unit of distance are observed in different routes. Taking an extreme case, in early 2021 a customer travelling between Madrid and Segovia (distance 97 kms) would pay a fare of 4.16 €, or slightly more than 4 cents per kilometre, while a trip between Barcelona and Lleida (148 kms) had a price of 22.27 €, or 15 cents per kilometre. Such differences may be due to very diverse factors, such as existence of alternative modes of transport, consumers' income levels or operators' costs. However, they may also respond to differences in the regulatory framework and the contract characteristics under which each service is provided.

The changes in the terms of tender offer a good scenario in which to test up to what point incentives to compete for the contract may have an impact. In particular, the aim of this paper is to empirically test if observed price differences can be due to the differences in the regulatory regime under which each service operates.

Little is known about the specific impacts that contracting out characteristics have on the bids of firms competing in the bus tendering market. Some papers have analysed how the design of the terms of tender may affect the operating costs or efficiency of operators, with the

* Corresponding author.
*E-mail addresses:* javier.asensio@uab.es (J. Asensio), anna.matas@uab.cat (A. Matas).

[1] See Aarhaug et al. (2018), Aarhaug and Fearnley (2016), Alexandersson et al. (2010), Beria and Bertolin (2019), Beria et al. (2018), Blayac and Bougette (2017), Dürr and Hüschelrath (2015), Reynolds and White (2022), Thust et al. (2016) and van de Velde (2014) for different analyses of the liberalisation process in these countries.

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assumption that such cost decreases would lead to better outcomes for consumers. Based on competitive tendering of local buses in Germany, Beck and Walter (2013) show that setting appropriate tender conditions regarding vehicle schedules, frequency and timetables increases the operators' ability to optimise circulation plans and schedules, with a consequent cost-decreasing impact and, hence, lower prices. Conversely, introducing vehicle requirements that increase the risk borne by the operators has the opposite effect. Using aggregate Swedish public transport data Holmgren (2013) estimates a decline in the average efficiency of operators over time. Among the factors that can explain it, Holmgren points at increases in network density and detailed demands on vehicles' design. Nonetheless, such requirements can be partially related to stricter environmental and safety standards, which is not necessarily bad. Vigren (2018) finds that different forms of contract designs have an impact on the number of bidders participating in tenders for bus contracts in Sweden. Given that for tendered bus contracts more bidders are viewed as a way to improve tendering results (Cantillon and Pesendorfer, 2006), tender characteristics that increase bidding participation may reduce prices. Along the same lines, using data of London bus contracts, Amaral et al. (2013) find that a higher number of bidders is associated with lower costs of service. Our paper contributes to this literature by providing evidence on how specifications and requirements in contracts affect the prices offered by bidding operators.

In order to do so, the next section explains the main features and recent evolution of intercity bus regulation in Spain. Section 3 reviews the recent literature on the estimation of price equations for long-distance bus services. Section 4 describes the dataset collected for this empirical research, while section 5 presents the results of the econometric model we use to test our main hypothesis. Section 6 discusses our findings in the light of the design and effects of contracting out bus services. Section 7 concludes.

## 2. The Spanish intercity bus market

In Spain, all regular intercity bus services are provided by private operators acting as regulated monopolists during a given period of time.[2] Two types of situations can be identified, depending on the inter- or intra-regional character of the services. In the case of services that connect origins and destinations in different regions of the country, the regulatory authority is the national government's Ministry of Transport. For those routes that take place completely within a given region, the Transport Department of the corresponding regional government will be responsible for awarding and regulating the provision of the services.

The main piece of legislation is the 1987 Transport Law (LOTT),[3] which established the current system of services' tendering by means of a multidimensional auction mechanism. This implies that a pre-specified score function is used to compute the points obtained by each bidder on each variable, weighting the scores to result in an outcome on a 0–100 scale, with the winner being awarded the contract.

The decision as to which variables are included in the score function and the weights given to each one of them are taken by the regulator when designing the terms of tender for each auction. The law allows the regulator substantial leeway in such choices, although the price paid by the user and the level of frequencies[4] always need to be included as variables in the score function. We refer to the variables and weights included in a particular version of the terms of tender as a regulatory design. Usually, a given regulatory design is used for a set of contracts awarded during a period, with the Ministry of Transport declaring that its purpose is to keep them constant for as long as possible. However, as will be mentioned later, in recent years there have been frequent changes in the regulatory design. We exploit such variability to identify the impact on the prices paid by the users.

In the case of inter-regional services, a contract typically combines high-density routes that can return positive margins together with services connecting with rural or low density areas, which are usually loss-making ones. As services are provided as net-cost contracts without any operation subsidies, the system implies a cross-subsidisation from users of profitable services towards those in routes that run at a loss. However, the operator of a loss-making route can apply to the regulator for a modification of specific itineraries or frequencies, or even for a merger of different contracts provided by the same operator. Intra-regional routes very frequently receive subsidies directly from the regional governments, under Public Service Obligations schemes.

At the time of passing the LOTT, in 1987, the then existing services were automatically turned into proper concessions, directly awarded to its incumbent operator and given a 20-year extension of the contract. Other services were created as new routes, awarded by means of a competitive auction under the rules previously described. These auctions were very contested, with up to 29 firms bidding for the Madrid-Málaga-Algeciras contract or 23 for the Irún-Algeciras one. Such level of competition for the market resulted in lower prices than those offered by the services whose contracts were extended (OECD, 2001). For instance, prices on the Madrid-Sevilla route, which was tendered at that time, were 30% below those of the comparable Madrid-Bilbao one, whose concession was one of the extended ones (Barrio, 2013).

The initially expected period of 20 years during which no contracts would be re-tendered was extended in some cases by means of different measures whereby operators would be granted longer operation periods if they kept price increases under certain limits. This policy can be understood in the context of Spain's efforts to meet the Maastricht Treaty convergence criteria in the second half of the 1990s, and in particular the one referring to inflation control. Other extensions were granted as a consequence of particular mergers between contracts operated by the same or different firms.

The result of such extensions was that, contrary to what would be expected given the 20-year limit set in 1987, not all the re-tendering processes took place in 2007. On that date, the Ministry of Transport reached a compromise with the business association of bus operators running the services and the trade unions representing their workers, by means of which the terms of tender to be used in the retendering of contracts were agreed on. These terms of tender were severely criticised by Spain's competition authority on several grounds (CNC, 2008). Among the most important issues were the low weight given to price and frequency bids in the score function together with the upper and lower limits set for such bids, the requirement of already being an operator of a regular service to submit an offer, the broad discretion in the assessment of non-economic criteria and the right of preference for the incumbent in case of tie. As a result, the Ministry modified the terms of tender to be used in 2009. However, leaving aside a slight increase in the weights given to price and frequency and some other minor changes, the main anticompetitive terms remained (CNC, 2010).

By that time, some bus companies not operating regular services had taken all the terms of tender used since 2007 to the Administrative Court, where a ruling declared them void. Thus, the Ministry of Transport had to issue a new version of the terms in 2011 which could be considered to be more pro-competitive. Among the favourable changes were a new score function that gave 40% of the weight to prices and frequencies (25% and 15%, respectively), the reduction of the duration of the contract and the easing of the conditions to participate. However, those terms of tender were also contentious since they made it compulsory for the company winning the contract to take over the

[2] Although the time length of the contract is clearly specified in the terms of tender, delays in the re-tendering procedures may result in longer periods than initially planned. In early 2022 more than 50% of the contracts were beyond their expected re-tendering timetable.

[3] Ley 16/1987 de Ordenación de los Transportes Terrestres (LOTT).

[4] Operators bid in terms of 'bus-kms' offered, for a given itinerary, implicitly defining the level of service frequency. Here, we interpret the term 'frequency' as services per unit of time, and not as the time gap between services, so that higher frequencies make the service more attractive to the users.

incumbent's operator labour force assigned to that particular contract, under their existing labour conditions.[5] Other remaining features of the terms of tender that limited competition were the scoring system for price bids which the facto kept a lower limit that prevented full competition on prices and the maintenance of the right of preference for the incumbent in case of tie.

Only five contracts were tendered under those terms before the regulator was again taken to court by some firms, who won their case. Therefore, by 2014 another version of the terms of tender was issued which finally suppressed those features that were judged to be anti-competitive by the courts (CNMC, 2014). By that time, a significant delay had built up in retendering expired contracts. Regarding the score function, the new system established a clear distinction between criteria that are assessed according to value of judgements and those that rely on a formula. The first group includes variables such as vehicle comfort, customer service, measures addressed to obtain security certificates, energy efficiency programs and incentives to connect with other public transport modes.[6] In the second group fares and frequencies are the most important variables. Additional variables that were also assessed by means of a formula are vehicle age and the commitment to fulfil quality standards according to pre-established regulations. The 2014 terms of tender gave a 55% weight to price and frequency variables, which were assessed with a proportional score system in order to encourage competition. However, upper price and lower frequency limits were still imposed, and in 2015 the Ministry of Transport applied significant increases in the maximum bidding prices and reductions on the minimum frequency limits without any explanation as to how the magnitude of those changes was decided. Those terms of tender also extended the compulsory taking-over of the incumbent's labour force to all workers in related activities, such as fare collection, maintenance, or administrative duties. Given the ability of the incumbent to flexibly define such assignments, this requirement can be regarded as an important advantage for the incumbent, as it would be better able to integrate its own workforce. Other features that could be detrimental for competition were a fee payable to the Ministry of Transport equal to 1% of the winner's turnover and a participation requirement consisting in having at least three years of experience in equivalent services with a bus fleet of similar size.

In 2016 a new version of the terms of tender was issued that, without essentially modifying the requirements to bid and the structure of the score function, increased the importance given to fares up to 45%, while that of frequencies fell to 10%. Additionally, the computation of both price and frequency bids was modified from the previous proportional system to a new two-part method, with different ways of computing the points depending on whether the bid was on the upper or lower half of the distribution of submitted bids. The system was designed so as to encourage more aggressive price and frequency bids.[7]

These terms of tender raised strong criticism from the incumbent operators, to which the Ministry of Transport was sensitive. In 2018, new specifications for the tenders were approved which meant a return to less pro-competitive conditions. Among the changes, it is worth noting a decrease in the weight given to price and frequency bids to 51% and a new score system for the price variable that severely limited the point difference awarded to below average bids. Additionally, a new 'podium' system was introduced to value some of the items requiring a qualitative assessment in such a way that only the best bid obtained the maximum number of points, the second got a lower score and from the third onwards the number of points was again reduced. In comparison with the previous system, according to which each bidder could obtain the maximum number of points in each section, the podium system may introduce distortions. For instance, when technical offers are very similar the system widens the differences, and if an offer is well above the average the system does not reward it proportionally.

These terms of tender were used for just two contracts held in 2018, before a further modification took place in 2019 with the objective of restoring a more-competitive environment for bus tenders. Among other changes, the maximum duration of the contract could be set below 10 years, the obligation of the contract winner to pay a 1% revenue annual fee was supressed and the score system was similar to that of 2016 tenders. Only two contracts were issued using this system. Besides, in all tenders issued in 2018 and 2019 the regulator suspended the procedure before the contracts were finally awarded, so we observe no price data in routes subject to such regulatory designs and, consequently, none of them enter our sample.

Table 1 provides a summary of the variables entering the score function together with the corresponding weights. When reading this table, two facts must be taken into account. Firstly, changes in the definitions of variables make it difficult to classify all items entering the score function into the same broad categories. Hence, comparisons should be made with caution. Secondly, besides the score function, the terms of tender included a set of compulsory requirements regarding vehicles, labour force take-over and the fulfilment of quality regulations together with guarantees of technical, financial and professional capacity of the firm. Therefore, the technical issues included in the score function have to be interpreted as improvements above the standards established in the contract.

In summary, from 2007 onwards (with the exception of 2018), bidding for long distance bus services was developed in an increasingly pro-competitive environment. The results of the different terms of tender show that score differences in the technical part – evaluated according to value of judgements – have been limited since all bidding companies can have the latest bus models, with similar characteristics for comfort, security and energy efficiency and can also access the same technologies to provide services such on-board internet connections. Hence, competition has taken place mainly on price and frequencies. Despite the scores given to prices and frequencies, there is no evidence of price competition at the expense of frequency of service. In more than 50% of cases the winner bid presented the highest bid on frequency. Nonetheless, a large number of suspensions in the procedures due to Court rulings or appeals makes it difficult to assess the actual results.

In addition to inter-regional services, our sample also includes intra-regional ones whose regulation, as has already been mentioned, depends on the regional governments. Some regions have passed their own transport laws, which may allow for explicit subsidies for loss-making services, while others follow the LOTT procedures. Nonetheless, in all of them the tendering systems prevails. Intra-regional services may have some distinctive characteristics as joint allocation of urban and regional services, on-demand services in rural areas, joint provision of schooling and regular services or subsidised contracts of different intensity. The available information does not make it possible to characterise each route according to the terms of tender designed by each regional government, as we have done for the inter-regional ones. Therefore, in the empirical analysis that we report below, we group all regional routes into a single category. It may well be that some of the specific characteristics of such contracts increase the operating cost and, consequently, distort the comparison among regulatory regimes. However, given that

[5] The previous terms of tender had given 20% of the total score to firms accepting such compromise, making it de facto a standard practice, since no contract was winnable without it.

[6] Specifically, some of the variables related to vehicle comfort are vehicle ergonomics or internet connection, whereas those related to attention to public include compensation for delays, complementary insurances and loyalty programs for frequent users.

[7] Specifically, for prices (frequency) bids above (below) the average, the points obtained varied with the bid at a constant rate. However, for bids below (above) the average the points obtained increased more than proportionally as the bid decreased (increased). The exact formula of the points obtained is given by $45 \cdot \frac{P_{min}}{P_{bid}}$, for bids lower than the average price bid ($P_{avg}$), where $P_{min}$ is the lowest price bid (which would obtain 45 points). However, for bids above the average the formula is $45 \cdot \frac{P_{min}}{P_{avg}} \frac{(P_{max} - P_{bid})}{(P_{max} - P_{avg})}$.

**Table 1**
Weights given to bid variables (%).

| Terms of tender | Price | Frequency | Labour force take over | Security and comfort | Customer service | Energy efficiency | Public transport promotion | Other | Total |
|---|---|---|---|---|---|---|---|---|---|
| 2007 | 10 | 5 | 24 | 26 | 13 | 8 | – | 14 | 100 |
| 2009 | 15 | 8 | 15 | 26 | 13 | 5 | – | 18 | 100 |
| 2011 | 25 | 15 | compulsory | 24 | 6.5 | 7 | 3.5 | 19 | 100 |
| 2014 | 35 | 20 | compulsory | 12 | 10.5 | 5 | 9.5 | 8 | 100 |
| 2016 | 45 | 10 | compulsory | 13.5 | 11.5 | 5 | 5 | 10 | 100 |
| 2018 | 35 | 12 | compulsory | 18 | 5 | 8 | 10 | 12 | 100 |
| 2019 | 49 | 20 | compulsory | 19 | 4 | 6 | 11 | 0 | 100 |

we only consider connections between provincial capitals our understanding is that services are offered on similar grounds and are, therefore, comparable.[8]

Summing up, current routes are operated under contracts that may have been awarded under one of the following nine regulatory regimes: the concessions extended when the LOTT was passed in 1987; the new contracts awarded competitively as the LOTT came into force; contracts which are the result of mergers between concessions of the two previous types; the terms of tender designed in 2007, 2009, 2011, 2014 or 2016 and, finally, intra-regional routes.

Our aim is to test whether such regimes have significant impacts on the prices currently paid by users. In order to do so we estimate a price equation, where additionally to the usual determinants of prices, we will include dummy variables corresponding to the specific regulatory design under which the contract was awarded.

## 3. Previous literature on price determinants of long-distance bus services

The estimation of price equations for bus services has become a common tool to assess the consequences of the liberalisation, as shown by different papers in the transport economics literature. Augustin et al. (2014) estimate price equations for services in the United States and Germany, defining the dependent variable as the price per distance. As explanatory variables they consider the journey's distance and time, number of stops and average service frequency, international connections (in the United States) or services to airports (in Germany), as well as a set of measures to take into account intermodal competition (train price, journey time and need to change trains). To observe the impact of competition, their US model includes the number of operators in the route, while dummies for the largest firms are considered in both cases. The reported results show that bus prices decrease with the journey's distance, although the inclusion of the number of stops as an additional variable makes it difficult to interpret the impact. In the US, prices decrease with the number of competitors, while the firm dummies reveal significant price differences between Greyhound and Megabus. In the case of Germany, the dummy for Flixbus services obtains a negative and highly significant coefficient. Also for Germany, De Haas, Herdold, & Schäfer, 2022 report that the takeover of PostBus by Flixbus (which coincided with the exit from the market by BerlinLinienBus), had the impact of increasing fares by between 8.3% and 9.3%.

Fageda and Sansano (2018) estimate price equations for intercity bus services, collecting data for a sample of national routes in Spain, France, Italy, Germany, Sweden and the United Kingdom. They report negative impacts of route distance and speed on prices per kilometre. They also find that the presence of alternative rail services diminishes prices, while that of air connections does not. The coefficient of their national market concentration measure (HHI index) is not significant. However, when it is interacted with the country dummies, the impact is strongest in Spain, implying that market structure has larger impact in terms of higher prices. The authors interpret this as a result of barriers to entry in Spain, which is the only one of the sampled countries without a liberalized market.

Beria and Bertolin (2019) study the Italian case, estimating a price equation for services operated during the year 2016. As all the previously cited papers, they too find a negative impact of travel distance on prices. Besides, there are significant differences depending on the operator providing the service. They also obtain results pointing at intense substitutability between bus services and railways or carpooling.

## 4. Data and variables

In order to empirically test the hypothesis previously outlined, we have collected data on a sample of intercity bus routes in Spain. One of the problems of gathering representative data for this purpose is to define routes where services provided are comparable in nature (i.e., not mixing rural or on-demand services with routes in high-density corridors). We therefore restrict our choice to connections between provincial capitals,[9] which usually corresponds to the largest city in each province. This results in a geographically balanced sample of origins and destinations. Therefore, connections between smaller villages, or between capitals and those villages, are not considered. This implies that the sample cannot be regarded as representative of the whole market for regular bus services in Spain, as a substantial number of routes provide connections to towns or villages with smaller populations than the cities sampled here. However, it should be a valid sample for our purpose of measuring the impact of regulatory changes on prices paid by bus users.

It should also be noted that although the services observed in our data are direct, in the sense of not requiring changing buses, they are not necessarily non-stop express connections, as there may be some stops along the journey. A connection in our sample is typically part of a longer bus route that links different cities.

We collected prices for regular services for travel on a particular date (September 23, 2019), three days prior to the trip. Prices were collected from checkmybus.es, a website providing prices and timetables for each bus service, but not directly selling tickets. In the cases where a connection is offered by more than one available direct service, we compute the average price. Additionally to the price and frequencies (number of services), other variables have been obtained from different sources. From official timetables we are able to obtain both road distances between each origin and destination as well as travel times, making it feasible to compute average speeds in each service[10]. We would expect a negative sign of speed in the price equation, as it reveals

[8] In order to check if our results are sensitive to the inclusion of the regional routes, we estimate our econometric model excluding those observations. The results are reported in Table A2 in the Appendix and are shown to be very similar, so our main conclusions do not vary.

[9] Spain is administratively divided into 17 'Autonomous Communities', to which we refer as regions, and a total of 50 provinces within them. Only the 47 peninsular provinces are considered here, as the 3 which are part of the Balearic or Canary Islands have no long-distance bus services.

[10] For intra-regional services we do not have access to official timetables showing exact route length. We obtain such distances as the best option for car travel from available map sites.

**Table 2**
Price equation variables. Descriptive statistics.

| | Obs. | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| Price (€/km) | 221 | 0.076 | 0.017 | 0.042 | 0.150 |
| Distance (km) | 221 | 490.3 | 271.9 | 60 | 1255 |
| Income pc (€) | 221 | 24250 | 4412 | 20512 | 36921 |
| Population (000) | 221 | 868.2 | 953.7 | 125.3 | 3719 |
| Plane (dummy) | 221 | 0.06 | 0.24 | 0.00 | 1.00 |
| Speed (km/h) | 221 | 74.4 | 9.7 | 46.5 | 101.3 |
| Bus/Rail travel time | 221 | 1.54 | 0.61 | 0.34 | 3.21 |
| Attractiveness index | 221 | 144.52 | 265.09 | 5.29 | 2184.28 |

the ability of the firm to provide more journeys per bus in a given time period, implying that buses of a smaller average size and fewer drivers may be needed (Fageda and Sansano, 2018).

Distance is used to build a relative measure of our dependent variable (price per km), but it is also included as an explanatory variable in order to test whether costs may vary with the route's length in the provision of bus services and the passing of its generated savings to consumers.

We define the market size for each route as the sum of the population of the two capitals it connects. The impact of market size on prices can be the result of two opposite forces. On the one hand, larger markets will result in more demand for bus services, which would push prices upwards. On the other hand, in competitive markets where demand levels are higher than the minimum efficient scale, market size can be expected to be negatively correlated with prices, as the entry process of new firms will typically push prices down. In our case, however, market entry is strictly regulated, so that the only response to higher levels of demand comes from the price bids that the operators may make in the auction, or from the participation of a higher number of operators in such auction. In both cases, the role of competition should result in lower prices being paid in larger markets.

We also include in the model the average of the two connected provinces' per capita incomes. Higher incomes should generate more travel demand, either directly from final consumers or as a result of higher levels of economic activity. However, intercity bus services probably are an inferior good for many users,[11] when other faster and more expensive alternatives are available (train, private car or plane). Therefore, the coefficient of this variable could take any sign.

We consider the impact that the availability of alternative modes of transport may have. In the case of air services, we construct a dummy variable showing whether direct connections existed at the time between airports in each province. Given that such services would be unfeasible for very short routes, we interact that variable with the log of distance (so that the relationship is not necessarily linear). To consider the competition between bus and rail services, we build a variable showing the relative travel times between origin and destination in each mode.[12] Slower bus than rail services would increase the value of such variable. Therefore, we expect a negative sign for its coefficient as firms would need to compensate longer travel times with lower prices.

Finally, we also consider an explanatory variable that measures how attractive a given contract may be for the private bus companies. As has already been mentioned, routes with different potential profitabilities are grouped into a single contract, with implicit cross subsidies among them. Therefore, the prices set on a given route will not only be affected by its own characteristics, but also by the relative attractiveness of the whole set of routes with which it is grouped. In order to obtain a synthetic index[13] of the overall attractiveness of each contract, we first compute for each route the ratio of the average population of the municipalities it covers over the product of the number of stops times the total distance of the route. The idea is that a short route without stops connecting cities with large populations will be more attractive that a long one with multiple stops in small villages. Then, the attractiveness index for the whole contract is obtained as the weighted average of the indexes computed for each one of its routes, where the weights are the number of residents living in the municipalities served by each route.[14] We expect a higher value of the index to be associated with a lower price.

Table 2 shows the descriptive statistics of the different variables, while in Table 3 the average values are computed for the different types of regulatory designs, as described in section 2. It can be observed that, without controlling for any other variable, prices are higher for intra-regional and LOTT routes. However, in order to properly assess the impact of regulatory designs we need to estimate an econometric model that includes all potential determinants of prices.

## 5. Estimation and results

The price equation that we estimate can be represented as

$$\ln pkm_i = \alpha + \beta X_i + \sum_{r=1}^{R} \gamma_r d_{ri} + \varepsilon_i \quad (1)$$

Where pkm is the dependent variable (price per kilometre paid in 2019, in euro cents), the variables in matrix X include a set of routes' characteristics: distance, income, speed, population, the ratio of travel times by bus over train and the contract's attractiveness (all in natural logarithm terms), as well as the plane dummy multiplied by the log of distance. Besides, the $d$ are dummy variables that take the value 1 if route $i$ is operated under a contract awarded according to the regulatory design $r$ of the R categories listed at the end of section 2. The concessions extended by the LOTT are taken as the reference category. The term $\varepsilon_i$ is the error term assumed to be normally and independently distributed. We are interested in the impacts on prices revealed by the $\gamma$ parameters.

An important issue is whether changes in the regulatory design can be considered exogenous in the price equation. As explained in Section 2, all the changes in the terms of tender have been forced either by the competition commission or by the Administrative Court. Therefore, the usual concern for endogeneity due to reverse causation would not apply in this context.

The results of estimating equation (1) by OLS are shown in Table 4.[15] For variables expressed in logs, their coefficients can be directly interpreted as elasticities. In accordance with the previous literature that estimates price equations for bus services, the coefficient for distance is found to be significantly negative. Prices per km decrease with the trip's length. This result can be interpreted as a type of increasing returns in terms of distance in the supply of bus services which are, at least in part, passed on to consumers. In the case of income, we obtain a negative coefficient, consistent with the previously discussed characteristics of intercity bus services as an inferior good. Market size, measured by population sizes, has a significantly positive impact on prices, implying that demand effects outweigh any potential price-reduction due to

[11] If intercity bus services are an inferior good, increasing incomes result in a leftward demand shift, thus decreasing both equilibrium price and quantity. Paulley et al. (2006) provide evidence of negative income elasticity for bus demand.

[12] The methodology followed to obtain such measures is detailed in AIReF (2019).

[13] See OECD (2008) and Greco et al (2019) for methodological discussions on synthetic (or composite) indexes, and Groh et al. (2010) or Lieser and Groh (2011) for applicaitons to capital and real estate markets, respectively.

[14] This method is valid only for inter-regional routes, included in contracts awarded by the national government. For intra-regional connections we compute an equivalent index on the basis of the non-stop and multiple-stop services in each route, assuming that both types of services constitute a contract.

[15] The results reported in Table 4 correspond to robust standard errors. The results corresponding to clustered standard errors at contract level, which may better control for possible autocorrelation between the routes in each contract, are reported in the appendix.

**Table 3**
Variables' mean values by regulatory design.

| Regulation | Obs. | Price (€/km) | Distance (kms) | Income pc (€) | Population ('000 inhabs.) | Plane (1/0) | Speed (km/h) | Bus/rail time | Attract. index |
|---|---|---|---|---|---|---|---|---|---|
| LOTT-ext. | 70 | 0.083 | 469.1 | 25 625 | 1250.5 | 0.08 | 74.68 | 1.62 | 215.2 |
| LOTT-new | 1 | 0.069 | 198.0 | 22 666 | 3340.8 | 0.00 | 72.00 | 3.17 | 307.8 |
| LOTT-merged | 46 | 0.074 | 491.1 | 23 593 | 813.1 | 0.11 | 71.63 | 1.46 | 111.9 |
| 2007 | 20 | 0.065 | 631.2 | 22 267 | 327.0 | 0.05 | 73.06 | 1.26 | 11.62 |
| 2009 | 10 | 0.056 | 871.2 | 25 650 | 1192.8 | 0.10 | 80.68 | 2.02 | 21.18 |
| 2011 | 16 | 0.061 | 478.1 | 24 688 | 540.2 | 0.00 | 80.51 | 1.31 | 84.07 |
| 2014 | 22 | 0.064 | 795.4 | 25 363 | 585.5 | 0.05 | 74.45 | 1.65 | 12.85 |
| 2016 | 2 | 0.043 | 183.1 | 24 834 | 2503.8 | 0.00 | 70.07 | 2.26 | 1214 |
| Regional | 34 | 0.092 | 173.2 | 23 498 | 546.8 | 0.00 | 73.60 | 1.44 | 735.7 |

**Table 4**
Estimation results.

| | Coefficient | Std. Err. | t-stat |
|---|---|---|---|
| Constant | 0.428 | 0.864 | 0.50 |
| Ln(distance) | −0.081** | 0.029 | −2.81 |
| Ln(income pc) | −0.156* | 0.077 | −2.03 |
| Ln(population) | 0.103*** | 0.015 | 6.84 |
| Ln(speed) | −0.474*** | 0.102 | −4.65 |
| Ln(bus/rail time) | −0.099*** | 0.027 | −3.62 |
| Plane x ln(distance) | −0.012* | 0.005 | −2.19 |
| Ln(attractiveness) | −0.023 | 0.013 | −1.81 |
| *Tenders* | | | |
| LOTT-merged | −0.131*** | 0.027 | −4.84 |
| LOTT-new | −0.307*** | 0.043 | −7.09 |
| 2007 | −0.197*** | 0.037 | −5.38 |
| 2009 | −0.314*** | 0.036 | −8.63 |
| 2011 | −0.214*** | 0.032 | −6.57 |
| 2014 | −0.239*** | 0.053 | −4.51 |
| 2016 | −0.769*** | 0.054 | −14.19 |
| Regional | 0.056 | 0.056 | 1.00 |
| R2 | 0.6258 | | |
| Observations | 221 | | |

(robust standard errors).
Legend: *p < .05; **p < .01; ***p < .001.

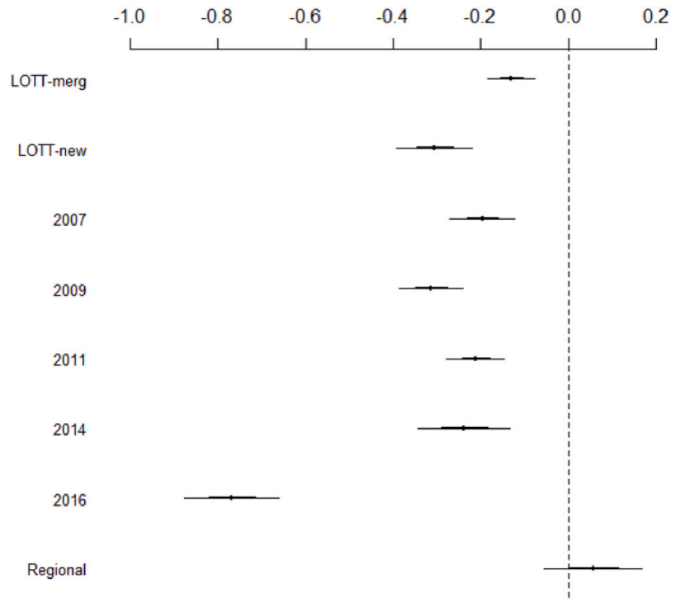


**Fig. 1.** Coefficient plot of estimation results
Reference category: LOTT extended contracts.

increased competition in larger markets. The availability of airplane services for long trips acts as a substitute to bus services, although with very small effects: for the mean length trip in the sample (490 kms), the existence of an alternative plane service implies a 3.3% reduction in bus fares. In the case of railway services, the faster they are the lower the price paid by bus users. A 10% improvement in rail travel times with respect to the bus from their mean value reduces bus prices by 1%.

We now focus on the dummy coefficients with which we want to test the response of prices to changes in the regulatory design. The coefficients and their confidence intervals are plotted in Fig. 1. The reference category are the services that were extended as the LOTT was passed in 1987. We observe that these correspond to the most expensive routes in our sample (together with the services awarded by regional governments, whose difference is not statistically significant). The contracts with the largest negative impact on prices are those awarded under the terms of tender of 2016, when the weight of prices in the score function reached 45% of the total. This version of the terms of tender can be considered as the one encouraging a most competitive bidding behaviour by the firms.

These estimation results imply that the regulatory design under which the contract was awarded can explain price differentials of up to more than 2 to 1. This would be the case if we compare the mean of the predicted price if all routes were provided as LOTT extensions (0.087 €/km) with the ones predicted if services were run under the 2016 regulatory design (0.041 €/km).

## 6. Discussion

The main conclusion from the results reported in the previous section is that contract design changes can have substantial impacts on fares paid by users of regulated bus services. With the available data we are not able to identify the channels through which such changes take place. They may be a combination of the limits set on different variables by the design of the contracts, the attraction of a higher number of bidders and the strategies put in practice by each potential operator to try to secure each contract. Our results imply that increasing the weight given to the most relevant variables, such as prices and frequencies, results in lower prices for users.

The analysis explained in the previous sections touches on several issues related to the design and effects of contracting out bus services, as have been discussed in previous Thredbo workshops (see Mekert et al., 2018, van de Velde and Alexandersson, 2020, or Preston and Walters, 2020 for accounts of those discussions).

One of the topics directly related to our analysis is that of the optimal design of contracts in terms of the relative importance given to price and quality variables (understanding that frequencies can be a measure of service quality). Ridderstedt et al. (2019) discussed this issue in the Swedish context and considered it preferable for the regulator to set

quality levels and allow for competition in prices. Hensher et al. (2000) are also critical on the use of scoring rules that combine both variables as they may have adverse selection effects. In the context analysed here, the problem may be made more evident by the relatively large number of additional qualitative elements that the terms of tender consider, adding complexity to the assessment of non-price variables. However, those elements are mainly related to bus operation characteristics that most firms should be able to satisfy in a relatively homogeneous way.

One conclusion that can be drawn from the analysis is the apparent lack of maturity of the regulation of Spanish long distance bus regulations. As shown in the analyses reported by van de Velde and Alexandersson (2020), a sign of such lack of maturity would be the frequent modification of the regulatory framework by the transport authority as a result of pressure from different interest groups. Although the Spanish system of 'competition for the market' has been in practice for more than 30 years without experiencing substantial legal changes, it has reached a situation of 'de facto' blockade due to the countervailing pressure of opposing interests. On the one hand, pro-competition agents such as the CNMC or the firms wishing to enter the market have had some success in obtaining increasingly open terms of tender. However, this has met the opposition of most of the incumbent operators. As the Ministry of Transport has been unable to unlock this situation, the retendering of more than 50% of the current contracts is overdue. Instead of proposing further changes to the terms of tender, the Ministry of Transport plans to aggregate the current 88 contracts into 22 much larger ones. If put in practice, this reform would provide clear evidence about the trade-off between benefits derived from economies of scale and the effects of limiting competition by restricting participation in the market to large companies.

At the time of writing (May 2023) a new Transport Law currently under Parliamentary discussion would allow for the opening to 'competition in the market' of some routes. This can be understood as an example of some movement along the regulatory or contracting cycle (Dementiev and Han, 2020), whereby the inefficiencies generated by regulations may end up leading to a change that opens the market to free entry competition. However, it is not clear how the new legislation would cope with potential monopolisation of the services by private firms, or the way in which loss-making services in rural areas would be guaranteed.

## 7. Conclusions

Unlike other European countries, Spain has not completely liberalized its long-distance bus market, opting instead to introduce competition by tendering sets of routes into single contracts. As in all cases in which the mechanism selected to provide transport services is one of 'competition for the market', the design of the terms of the tender becomes a crucial aspect to define the prices and qualities provided to the final users. Taking advantage of different regulatory conditions applied to inter-regional and intra-regional routes, as well as of changes in the details of the terms of tender for the former, this paper provides evidence of the relevance of such designs on the price paid by long-distance bus users.

The results are obtained by estimating a price equation for services between provincial capitals, which are provided by contracts awarded under different regulatory settings. Controlling for the main factors that may determine price differences, a statistically significant effect is found for the different types of terms of tender. Specifically, the highest prices are observed in intra-regional routes or in those inter-regional ones whose contracts have not been retendered since the 1987 Law. As an increasing degree of competition has developed since 2007, a reduction in the price paid is observed. This reduction increases as the terms of tender allow for more competitive bids to increase the probability of success. When we compare the extreme cases, our estimates predict a 53% reduction in prices per km if the services extended by the 1987 Law had adopted the terms of tender used in 2016, which are the most pro-competitive ones. The main changes introduced at that date implied giving a higher weight to prices in the auction's score function as well as allocating points on prices in a way that encouraged more aggressive bids.

The analysis reported in this paper shows that under a 'competition for the market' system the role of the regulator as designer of the institutional mechanism used to award the contracts can have very significant impacts on the outcomes. Maintaining such mechanisms relatively constant over time can be a very complex task, as the regulator will receive pressures from different parties, including incumbent operators (who will not participate in the tenders if they do not consider them attractive enough), consumers (asking for more affordable and, simultaneously, more frequent services) or even the government, who may prefer a system based on internal cross-subsidies to one in which loss-making services are financed from the public budget.

## CRediT authorship contribution statement

**Javier Asensio:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Anna Matas:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing.

## Declaration of competing interest

The authors have no interests that could bias or influence the results of this research.

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## Appendix

**Table A.1**
Estimation results (clustered standard errors at contract level)

| | Coefficient | Std. Err. | t-stat |
|---|---|---|---|
| Constant | 0.428 | 2.118 | 0.2 |
| Ln(distance) | −0.081 | 0.061 | −1.33 |
| Ln(income pc) | −0.156 | 0.157 | −0.99 |
| Ln(population) | 0.103** | 0.021 | 4.82 |
| Ln(speed) | −0.474** | 0.126 | −3.76 |
| Ln(bus/rail time) | −0.099** | 0.021 | −4.75 |
| Plane x ln(distance) | −0.012 | 0.008 | −1.59 |
| Ln(attractiveness) | −.023* | 0.008 | −2.77 |
| *Tenders* | | | |
| LOTT-mer | −0.131*** | 0.014 | −9.26 |
| LOTT-new | −0.307** | 0.068 | −4.52 |
| 2007 | −0.197*** | 0.031 | −6.39 |
| 2009 | −0.314*** | 0.033 | −9.65 |
| 2011 | −0.214*** | 0.033 | −6.38 |
| 2014 | −0.239*** | 0.040 | −6.04 |
| 2016 | −0.769*** | 0.067 | −11.41 |
| Regional | 0.056 | 0.049 | 1.15 |
| R2 | 0.6258 | | |
| Observations | 221 | | |

Legend: *p < .05; **p < .01; ***p < .001.

**Table A.2**
Estimation results excluding intra-regional services (clustered standard errors at contract level)

| | Coefficient | Std. Err. | t-stat |
|---|---|---|---|
| Constant | 0.942 | 2.362 | 0.4 |
| Ln(distance) | −0.0615 | 0.057 | −1.08 |
| Ln(income pc) | −0.194 | 0.170 | −1.14 |
| Ln(population) | 0.101*** | 0.022 | 4.51 |
| Ln(speed) | −0.510** | 0.167 | −3.06 |
| Ln(bus/rail time) | −0.117*** | 0.018 | −6.56 |
| Plane x ln(distance) | −0.011 | 0.008 | −1.38 |
| Ln(attractiveness) | −0.029*** | 0.008 | −3.68 |
| *Tenders* | | | |
| LOTT-mer | −0.144*** | 0.009 | −16.38 |
| LOTT-new | −0.267*** | 0.050 | −5.34 |
| 2007 | −0.226*** | 0.009 | −24.17 |
| 2009 | −0.332*** | 0.029 | −11.33 |
| 2011 | −0.214*** | 0.039 | −5.55 |
| 2014 | −0.261*** | 0.033 | −7.91 |
| 2016 | −0.728*** | 0.051 | −14.38 |
| R2 | 0.6714 | | |
| Observations | 187 | | |

*p < .05; **p < .01; ***p < .001.

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