

CEIS Tor Vergata

RESEARCH PAPER SERIES

Vol. 15, Issue 3, No. 400 – February 2017

Maintaining Competition in Recurrent Procurement Contracts: A case study on the London Bus Market

Elisabetta Iossa and Michael Waterson

This paper can be downloaded without charge from the Social Science Research Network Electronic Paper Collection
http://papers.ssrn.com/paper.taf?abstract_id=2923305

Electronic copy available at: <http://ssrn.com/abstract=2923305>

**Maintaining Competition in Recurrent Procurement Contracts:
A case study on the London Bus Market¹**

4th August 2016

Elisabetta Iossa² and Michael Waterson³

Abstract. Under recurrent procurement, the awarding of a contract to a firm may put it in an advantageous position in future tenders, which may reduce competition over time. The objective of this paper is to study the dynamics of competition for tendered contracts, focusing on factors that may generate incumbent advantage. Particular attention is given to learning economies, sunk costs of entry and switching costs for the procurer. The paper then applies these insights to analyse empirically the evolution of competition in the market for local bus services in London.

Keywords: Dynamic Competition, Procurement and Incumbent advantage.

JEL Classifications: L24, L92, L40.

¹ We thank Estelle Cantillon for providing us with much background information on the tendering and her mixed bundling work and Stephane Saussier for making his data available to us. We thank our research assistants Svetlana Bilalova, Chiara Carboni, Sergio Castagnetti, Daniele Surian, Paolo di Fonzo for their help with the data collection. We also thank various bus enthusiasts, particularly Robert Munster, for their provision of data. We thank for useful discussion and comments an anonymous referee, Sinan Corus, Giancarlo Spagnolo and Armin Schmutzler and conference participants to the “La competitività delle infrastrutture: perché e come, (Milan, June 2016) and CRESSE Conference in Industrial Organization (Rhodes, June 2016).

We acknowledge financial support from Laboratorio Bocconi Aspi Project and the Warwick Economics Policy Lab.

² University of Rome Tor Vergata, CEPR, IEFÉ-Bocconi and Center of Research in Procurement and Supply Chain (www.proxenter.it)

³ University of Warwick, UK. Waterson was involved in the Competition Commission market Inquiry into the British bus market, but this Inquiry related only to bus services outside London.

1 Introduction

In many sectors, procurement is repeated over time. In the road sector, for example, as well as major one-off projects such as river bridges, the Department of Transport, the Road Authority or private concessionaires repeatedly buy services from suppliers. The contracts cover road construction and paving projects, traffic signal projects and maintenance projects as well as smaller drainage and clearance type projects, water services etc. These contracts are auctioned off repeatedly to individual contractors typically via sealed-bid actions where the lowest bid is awarded the contract. However, there are major differences between unique and recurrent procurement.

Contrary to one-shot procurement, under recurrent procurement, procurers and firms need to recognize the elements of interdependency that exist among successive tender rounds, rather than thinking of each tender in isolation. Being awarded a tender may result in a long-lived competitive advantage, which may decrease the possibility that competition will be sustained over time.

The objective of the paper is to study this tender interdependency and the factors that affect the dynamics of competition for tendered contracts. The paper discusses in particular the impact on bidding behaviour and future competition of learning effects, sunk costs of entry, and switching costs. We apply these insights to analyse the evolution of competition in the market for local bus services in London. Like the road sector, contracts for local transport services are auctioned off regularly, contracts are relatively standard, a limited number of pre-qualified firms exist, and costs of entry exist but seem not prohibitive. Many local authorities in cities all over the world contract out the operation of their local transportation, and competition is often limited, so the example is an important one.

Using a dataset of over 400 bus routes tendered at least twice by Transport for London (TfL) under essentially the same rules of competition, we obtained information on all tenders from 2003 to 2015. This enables a more complete investigation into whether competition is being maintained over time than a purely cross-sectional study. The data were collected from TfL websites augmented using additional websites as discussed in more detail later.

The tendering for transport services in London has drawn significant attention of researchers. Positive effects of competition have been found initially in Kennedy (1996) and subsequently in Amaral, Saussier and Yvrande-Billon (2009) who attributed them to

the transparent procedures and to the division of the market in small lots to encourage participation. Amaral, Saussier and Yvrande-Billon (2013) further show that more competition, in the sense of greater number of (expected or actual) bidders, is associated with lower prices paid by the procurer to the contractors, but also expressed concerns over the dynamics of prices. Cantillon and Pesendorfer (2006) found ambiguous evidence as to whether the system of combinatorial bidding used in these tenders is helping to exploit cost synergies among routes or it is instead serving as a tool to leverage market power. Our paper goes beyond this literature in focusing on the longer term impact of recurrent competition over time and the factors influencing it.

The paper is structured as follows. In Section 2, we discuss the factors that affect the sustainability of competition over time. In Section 3 we describe the market for London bus services which in Section 4 we analyse empirically. Section 5 concludes.

2 Incumbent Advantages: causes

In this section, we describe the main factors that may generate an advantage for the winner of the current tender (hereafter referred to as the “incumbent”) in future tenders, compared to other bidders. We focus on learning effects generating productivity gains or better knowledge on the returns from future contracts, fixed and irreversible costs of entry (“sunk costs”) and switching costs for the procurer. We discuss each of these effects in turn.

Learning Effects. When awarded a contract, the supplier acquires experience on the contractual tasks, which may help it to reduce its operating costs.⁴ Whilst this cost reduction may appear as good news for the procurer, who may expect more competitive offers in the future, a more careful analysis suggests that this need not be the case, as learning effects may make subsequent procurement less competitive and more costly.

Lewis and Yildirim (2002) were among the first to study this experience-competition trade-off in a repeated procurement setting with price competition, where the firm submitting the lowest price offer wins the contract.⁵ They model the dynamic relation

⁴ . A number of empirical studies have indeed found evidence that learning through experience has reduced costs in the production of nuclear power, chemicals, airplanes, ships, machine tools, computers and semiconductors and electrical equipment. See the studies cited in Lewis and Yildirim (2002).

⁵ Earlier works by e.g. Anton and Yao (1987), Demski et al. (1987) and Dana and Spier (1994) deal with sequential procurements and analyse how potential future competition among suppliers affects their

between the procurer and two suppliers as an infinite horizon Markov game and show that learning economies yield:

- Fierce competition for earlier contracts: Suppliers will compete vigorously in early periods, even offering prices lower than their costs in an attempt to win the contract and then benefit from learning economies in future tenders. This penetration pricing provides the procurer with significant surplus early on, as the cost of the contracts will remain low, even before sellers have moved down their learning curves.
- Lock-in by existing suppliers on later contracts. In later periods sellers begin to earn positive profits and, as their competitive advantage increases, their profit margins increase. Over time, the cost advantage gained by the incumbents make their position compared to competitors so strong that market tipping occurs. The gap in the cost of providing the service for competitors is so much higher than for the incumbent that no other firm remains competitive. The procurer is now locked-in.⁶

These two contrasting effects are such that overall whether the procurer benefits from suppliers' learning from experience depends on the extent of the learning economies and the strategies adopted by the procurer to avoid lock in. In some cases, the procurer incurs greater acquisition costs because experience softens competition.⁷ The range of effects is analogous to the range of outcomes in the switching costs literature (see Belleflamme and Peitz, 2015, ch. 7), on which see below.

Beyond increasing productivity, experience can also produce better information on the cost and benefits of future contracts, thus reducing uncertainty of payoffs and creating an information advantage for incumbents with respect to entrants. De Silva, Dunne and Kosmopolou (2003) find evidence of this effect in the bidding patterns of entrants and incumbents in road construction auctions in the State of Oklahoma between January

current behaviour but does not look at how experience affects dynamic competition. Cabral and Riordan (1994) analyse market competition when consumers as well as suppliers act strategically.

⁶ The theory of asymmetric auctions indeed predicts that, when bidders face different cost distributions and this is known, weak bidders (i.e. bidders with cost distributions that stochastically dominate those of strong bidders) tend to bid more aggressively when they know that they will be competing against stronger bidders: their bid function stochastically dominates the one of more aggressive bidders. Maskin and Riley (2000) first prove this result in the context of first-price auctions. If there are systematic differences in costs, firms with higher expected costs (weak firms) will bid on average more aggressively relative to their costs than firms with lower expected costs (strong firms).

⁷ Mattera and Zampino (2015) extend the analysis to the case where contracts are not judged on the basis of the lowest price, but on the best value for money where firms submit quality and price offers and obtain award points on each of them.

1997 and August 2000.⁸ In particular, entrants bid more aggressively and win with lower bids than incumbents because they have less experience and greater uncertainty about their own costs. Their bids indeed show a greater dispersion than those of incumbents.

In a similar vein, Li and Philips (2012) examine more than 7,500 Utah construction procurement auctions and find that entrants bid more aggressively and their bids are more widely dispersed around the central tendency of bids than those of incumbents.

An implication of these studies is that information released before the auction may induce on average more aggressive bidding behaviour by all bidders, as it decreases private information rents. This can help entrants compete against incumbents, re-evaluating their bids and avoiding excessive losses (De Silva, Kosmopoulou and Lamarche 2009).

Empirical evidence shows that learning experience also affects firm duration. De Silva, Kosmopoulou and Lamarche (2011) collected data on auctions for road construction activity in Texas in the period from July 1999 until December 2006. Auctions were held each month using the first-price sealed-bid format. The data set contains information on project characteristics, winning bidders and bids. It also provides the winning bidders' subcontractor names and corresponding negotiated subcontractor dollar value. Their empirical evidence suggests that acquiring subcontracting experience before becoming a primary contractor decreases the probability of exit from the industry and significantly prolongs firm duration. Moreover, primary contractors with previous experience have a smaller probability of exiting the market than primary contractors with no previous experience.

Sunk Costs and Activism. Incumbent advantage may also arise when production requires irreversible cost of entry. The impact of these sunk costs on future tenders was first discussed informally but powerfully by Williamson in terms of transactions costs: "... the initial large numbers bidding competition will be *transformed* into one of bilateral exchange at the contract renewal interval *if* execution entails non-trivial transaction specific investments." (Williamson, 1981, p.571, emphasis in original). An incumbent will likely be in a privileged bidding position due to its ownership of specific assets already in place.

⁸ The presence of entrants, in general, increases competition and makes it more difficult to have collusive agreements, such as bidding rings, but at the same time they stress the fact that entrants may be highly disadvantaged. These asymmetries are rarely emphasized in the auction literature.

Theoretically the role of sunk costs on the dynamics of competition has been recently studied by Iossa, Rey and Waterson (2016) in a repeated procurement setting where a public authority procures the supply of a public service to private firms. The market for the public service is divided into two lots, and for each lot, a two-period contract is tendered. A lot may for example be represented by a bus route (or group of routes), or by a motorway infrastructure, or by a train service on a specific route. Each contract execution requires perfectly homogeneous skills. Firms are identical and bear identical operating costs for providing the two-period service.

A key element of the analysis is that a firm's gain due to experience exhibits decay. Incumbency is associated with lower sunk costs but only for one period. Experience is also market specific, as it is associated with a greater reduction in sunk costs when it refers to the market that is up for tender and not to a nearby market. The importance of this information decay is that it creates a constant drive to be awarded a contract, so as to remain active in the market. The authors then show that this activism effect may either result in sustainable competition or in monopolization, depending on the level of the decay in the value of experience and on the sunk cost.

Switching costs. Incumbent advantage may also stem from the knowledge the procurer acquires about the adopted technologies which in turn affects its cost of switching technology. If technologies operate under dynamic increasing returns, due to learning-by-doing and learning-by-using, events early in the process, especially an early use of a specific technology, can make it become preferred.⁹ Cowan (1990) finds these learning effects underlie the dominance of light water in the production of nuclear power, and the consequent technological lock-in at the expense of other kind of technologies available by the late 1950s.

In a similar vein, organizations may sometimes find it difficult to change a supplier after the expiration of a contract, because not all essential information or technologies for production is readily available for efficient takeover by another provider. This switching cost generates supplier lock-in.¹⁰ In ICT for example a survey of 244 procuring authorities in 2011 found that at least 40 percent of them considered that changing their existing ICT solution would be too costly because it would involve changing many other systems that used the data of the current system and information was not transferable.¹¹

⁹⁹ See Farrell and Klemperer (2005).

¹⁰ <http://ec.europa.eu/digital-agenda/en/open-standards>.

¹¹ <http://cordis.europa.eu/fp7/ict/ssai/docs/study-action23/study44-survey1results.pdf>

Switching cost may also make it less credible for procurer to take the service or production in house, if they lack the necessary technology.

In a study of US cable television concession contracts, where concessionaire had to incur significant sunk costs to provide the service, Zupan (1989) found that the incumbent supplier was renewed in more than 99.8% of contract expirations- A sign that competition from alternative providers did not constitute a real threat for the incumbent. However, the terms of renewal contracts were also found not to differ substantially from those of new contracts, possibly because the procurer managed to control prices by threatening credibly to provide the service in house.

Low switching costs have also been argued to explain why large municipalities in France are less likely to renew an incumbent contractor that charged an “excessive” price. Compared to the small municipalities, large municipalities face lower costs of switching and can therefore more credibly threaten the incumbent to bring service in-house should prices be excessive. (Chong Saussier and Silverman, 2015). Indeed, while large municipalities responded to “excessive prices” by switching provider or organization form, small towns’ renewal decisions were unaffected by a provider’s past pricing.

Capacity Constraints. Finally, we note how incumbency may sometimes also give rise to some disadvantage at bidding stage. This occurs in particular if capacity constraints matter. If two firms have symmetric capacity in a period prior to the auction, when the winner is committed it will be more constrained than the current loser, and the higher profits it gains from winning the current auction will lead to lower profits in the future. So, beyond a certain point, if the firm’s commitments increase, it experiences higher marginal costs for the new projects. Comparing this to the lower costs of a firm that has no current commitment leads to an endogenous asymmetry: the current winner will be disadvantaged in future auctions relative to current losers, so that the firms face an inter-temporal trade-off.¹²

Jofre-Bonet and Pesendorfer (2000, 2003) study procurement auctions for highway construction contracts of the State of California between 1996 and 1999. The estimates show that bidders which have committed only a small fraction of their capacity are

¹² The paper raises interesting questions about the strategic response of forward-looking bidders to this trade-off, what schedule of auctions minimize the procurer’s costs and if it is better to have frequent auctions for small projects or less frequent auctions but larger ones, and provides some main findings about these issues. Saini (2012) shows that shorter and more frequent auctions help to enhance competition over time. Lumpy or less frequent procurements lead to more asymmetric capacity utilization levels which in turn raises the cost of procurement.

about twice as likely to submit a bid as bidders who have committed a large fraction.¹³ Furthermore, firms with higher capacity utilization experienced a first-order stochastic dominance shift in their cost distributions compared with less constrained firms. Similarly De Silva, Dunne and Kosmopoulou (2002, 2003) find empirically that firms with greater backlogs bid higher prices in procurement auctions in Oklahoma.

3 The London Bus Market

To gain insights we shall consider what is believed to be one of the most successful experiences of competitive tendering in Europe for the award of local transport services: the London bus market, a large market now serving about 9 million people, with nearly 9000 buses and a total of 675 routes (Verbich and El-Geneidy, 2016).

In particular, in Section 3.1 we describe the characteristics of the tendering process. In Section 3.2, we shall report some descriptive statistics on contracts and the level competition. Following on from that, in Section 4 we engage in regression analysis to investigate those factors which affect price dynamics.

3.1 Description

The market. Almost a quarter of all local bus miles run in England are in London, although of course the population of London is substantially less than $\frac{1}{4}$ of the population of England. Moreover, bus patronage has been growing in London, up 32% between 2004/5 and 2013/4, whereas it has been essentially static outside London,¹⁴ so that remarkably over $\frac{1}{2}$ of total English passenger bus journeys are now made inside

¹³ Moreover, increasing the backlog appears to monotonically decrease the probability of submitting a bid (although there are some exceptions). The probability of submitting a bid declines monotonically in backlog: When backlog equals 0, the probability equals 6%; it falls to 5% as backlog increases to 0.5; and when backlog exceeds 0.7 the probability of submitting a bid declines to 2%.

¹⁴ Secular decline in the numbers of bus travellers outside London was stemmed but not reversed by the introduction of national free bus travel (commonly after 09.30) for people over 60 (initially), subject to possession of a free travel card, in 2006.

London (Department for Transport statistics, 2014).¹⁵ Table 1 lists some key parameters of the market.

Table 1: Some characteristics of London Buses

| Statistic | 2003/4 | 2004/5 | 2005/6 | 2006/7 | 2007/8 | 2008/9 | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | Average growth % |
|--|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|------------------|
| Passenger Journeys (millions) | 1854 | | | | | | | | 2320 | 2311 | 2382 | 2385 | 2.6 |
| | | | | 2069 | 2176 | 2247 | 2257 | 2289 | 2344 | 2335 | 2405 | | |
| | 1702 | 1793 | 1816 | 1880 | | | | | | | | | |
| Kilometres operated (millions) | 437 | 450 | 454 | 458 | 468 | 478 | 483 | 486 | 490 | 490 | 491 | 489 | 1.1 |
| Percentage of schedule operated | 97.2 | 97.7 | 97.7 | 97.5 | 97.5 | 97 | 97.1 | 97.4 | 97.6 | 97.6 | 97.7 | 97.1 | |
| Excess wait time (high frequency) minutes | 1.4 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1 | 1 | 1 | 1.1 | |
| Customer satisfaction level | 77 | 78 | 78 | 78 | 79 | 80 | 79 | 80 | 80 | 82 | 83 | 85 | 0.9 |
| Source:TfL Derived from Annual Reports, various years. | | | | | | | | | | | | | |
| Note that there have been two rebasings of passenger numbers, making comparisons across the whole set of years problematic. | | | | | | | | | | | | | |
| However, for rough comparative purposes, a figure for assenger numbers for 2003/4 has been listed on the basis of the chaining years 2006/7 and 2011/12. | | | | | | | | | | | | | |

¹⁵ Outside London, the bus services are organised substantially differently, with tendering taking place only for a small minority of marginal routes.

The tender competition. The familiar London bus is the subject of a complex and extensive operation in tendering. Despite the common red branding, London's bus services are run by several different operators, virtually all operating on gross cost contracts. Service provision is dictated by Transport for London (TfL) which is ultimately under control of the Mayor of London.

TfL organises tender competitions to choose operators. Start (and termination) dates are widely spread, so that the contracts are put out to tender every two to three weeks, on a rotating basis. The contracts are for service on a particular route, where the route, timetable, vehicle quality and service quality have been specified by TfL. For example, the so-called 2015-16 tendering programme, starting with tenders issued in April 2014, contains 40 separate sets ("tranches") of contracts, covering around 180 bus routes, with between 1 and 10 bus routes being the subject of tender returnable by a particular date.

The choice of routes tendered on a particular date is not random; commonly for example routes in a similar area of London are issued together, so that for example (the largest) Tranche 490, issued on 1st September 2014, comprised 10 routes, covering routes focused on south-east/ south London a few miles from the centre. Tenders for these were due on 13th October 2014, with decisions to be announced in January 2015 and services to start operation from 29th August 2015.

The routes themselves are largely unchanging over time, although some more routes have been added and frequency enhancements (and, more occasionally, reductions) have been built into the new contracts from time to time. For example, when the London congestion charge was inaugurated in February 2003, significant enhancements to bus services were introduced at the same time. Improvements in information technology, such as GPS location, have substantially enhanced monitoring of adherence to schedule as well as provision of customer-focused advance information of various types. Fares are no longer proffered to the driver but instead purchased through machines at the bus stop or, more commonly, by using the Oyster card, which was introduced on 30th June 2003, and more recently also by contactless debit card.¹⁶

¹⁶ The Oyster card was an instant success, partly due to the low basic cost and substantial discounts it offers to the transport user, including capping of daily fares, etc. More than 60 million Oyster cards have been issued and in 2013, 85% of journeys in London were made using them, so their use extends much beyond the regular London traveller. From 2014, buses have also accepted "contactless" payment cards. Payments to the driver's cashbox are no longer accepted on any part of the system. Source: <http://www.digitalspy.co.uk/tech/news/a494731/londons-oyster-card-turns-10-years-old.html#~oTB9poLY3Aq4MU>

Entry costs. The lag between announcement and delivery arises because the new operator, if the contract changes hands, will need to have crew and buses in place, together with a garage or similar accommodation for stabling and maintenance. London bus routes commonly require new buses at start of a contract. Indeed, the tender may call for buses of a standard above that currently in operation on the route, for example to a tougher emissions standard, so the existing operator who wins may also be forced to purchase new vehicles.¹⁷

Most buses are owned or leased by the operators¹⁸, and they can choose the precise vehicle subject to quality constraints (including perhaps a direction to purchase a hybrid vehicle; there are 600 conventional hybrids in London). Typically, they last over two contract periods in London. For the most part, the buses are not specific assets, because of a significant second-hand market, although there are complaints from operators that London buses are “over-specified” and need to be “de-specified” for use elsewhere.¹⁹ Alternatively, buses can be leased rather than purchased. There are three British-based bus makers (SMMT, 2010) in addition to suppliers such as Volvo and Mercedes, who can supply buses to London specifications.

Obtaining garaging facilities is potentially more problematic, although there are one or two examples where companies share garage space. Most garages have been in place for many years, indeed some are converted from former trolley-bus or tram depots. Ownership of garages being fixed in the short term may constitute a barrier to entry, favouring owners or garage, who are presumably the incumbent firms. However, whether by luck or design, London’s bus garages are spread amongst operators in such a way that there is likely to be more than one company near enough to a route to

¹⁷ Except for routes where New Bus for London is specified, or Heritage routes, the particular vehicle is not specified, so that companies can and do purchase buses from any of a number of providers.

¹⁸ The New Bus for London is an exception in that these are owned by TfL and leased to operators on routes where they are designated. There is a gradual limited roll-out of NBfL starting in mid-2013, with total numbers projected to reach 600 (out of a total fleet of over 8000) sometime before 2020.

¹⁹ The specifications for London buses are “tougher” than for those outside the capital, where responsibility for vehicle serviceability is in the hands of Traffic Commissioners, individuals with huge areas to oversee (Competition Commission, 2011). There are only eight of these individuals to cover the whole of Great Britain and they have responsibility for trucks as well as buses. Apart from average quality level, London buses are idiosyncratic in minor ways and so need adaptation for use outside London. One of the most obvious differences is that London buses normally have two doors, one for entry and one for exit, whilst outside London it is usual to have only one. The introduction of the New Bus for London on several routes has modified the arrangement somewhat. These buses are not obviously adaptable for use outside London and are substantially more expensive than other buses, so are leased rather than bought.

provide a coherent competitive bid for the route.²⁰ In the case of a company gaining or losing a contract which is not offset by losses or gains elsewhere, there will be implications for bus and driver requirements and possibly for garaging and maintenance facilities. With a total fleet in London of around 8,000 buses in operation, and even the largest route only having a peak vehicle requirement (PVR) of around 70 buses, there will be relatively limited implications for a medium to large operator. Smaller operators in particular may face the need to acquire or dispose of buses and possibly a need to acquire additional space.

At most times of the economic cycle, recruiting bus drivers is not a significant issue and there is ample time for training new ones (from an existing operator's viewpoint) within the gap between contract award and commencement of operations.²¹ There is no obligation for entrants to hire the drivers of the incumbent.²²

Who does what? The key roles for operators are: To develop and submit bids, timetables, schedules and staff rotas, to provide and maintain premises and vehicles, to recruit, train and manage staff and to engage in day to day management. TfL, for its part, determines the tendering programme, routes and frequency, monitors quality and safety, sets minimum standards and capacities for buses and handles all aspects of fares, plus network facilities.²³

The payment system. The gross price specified in the contract is subject to a formula-driven annual increase over the life of the contract, with the formula based upon a few key cost elements. Within the formula, efficiencies over time are assumed, because the cost uplifts apply to only 85% of the price. This system of gross cost contracts, subject to quality payments which may go either to or from the operator (from the operator in the case of significantly below-tendered performance), has been in operation in essentially the same form since 2001 and results have been reported online since 2003. Most tenders are for an initial five years, although it is quite common for the operator to be offered an extension of a further two years on the same terms, subject to performance.

Tenderers must submit a compliant gross cost tender, which is a tender that fully meets the requirements set out in the tender document such as quality and adherence to

²⁰ A map of the main London bus garages by operator is available at: http://www2.warwick.ac.uk/fac/soc/economics/staff/mjwaterson/london_bus_garage_map.pptx

²¹ This is implied by comments on, for example, the Arriva website.

²² On this see the union TSSA: <https://www.tssa.org.uk/en/Your-union/your-workplace/employment-rights/tupe--a-guide-to-the-regulations.cfm>

²³ More detail is provided in TfL's "London bus contracting and tendering process", which appears to be a "living document".

timetable, to be provided for a defined annual payment. However, they are also free to propose alternatives which may modify some aspect of the service. One of the most common modifications is to offer a package price for a bundle of routes provided that this is less costly than the sum of the tenders for individual routes. In other words, there is the possibility of mixed bundling.²⁴ Subject to this qualification, it is normal for TfL to select the tenderer offering the lowest annual price, and if it does not it will provide a brief explanation. The logic behind this mixed bundling is possibly that bundled routes benefit from geographical proximity which allows to exploit some economies of scale if the same operator provides the service on all of these routes.

Available Information. There is a high degree of transparency. TfL publicises, on a route-by-route basis, the name of the winning tenderer, the number of tenderers, the price of the lowest tender, the price of the accepted tender, the price offered by the highest tenderer, the constitution of the package and its price, if any, plus a breakdown by route, and a price per mile run figure for the lowest tender (which clearly facilitates comparisons across routes and time). Cases where no tender is deemed acceptable appear to be non-existent, or at least extremely rare.

Despite this transparency, we expect that incumbents retain some superior information on the cost of providing the services. There is learning and idiosyncratic information embodied in specific knowledge regarding the London market, gauging the requirement for buses in response to traffic conditions given the timetable, supervising route operation, etc.

The data. The data we have collected include 402 routes from 2003 to 2015, where data was only collected in those cases where the same bus service was tendered twice within the period. The information was partially obtained from TfL's website, and partially manually collected from various other websites maintained by dedicated enthusiasts. In particular, from the TfL website, we obtained information on number of bids, lowest and highest bids, number of firms, whether the bid was a joint bid or not, and the name of the company that won the contract. We then investigated, using websites such as londonbuses.co.uk and londonbusroutes.net, the peak vehicle requirement and the history of the company, so as to see whether this company was an existing firm in the market, a new entrant or it was simply an incumbent with a different name and also noted key elements in the history of the route and its garage. We also used information from sample contracts provided (under Freedom of Information requests) on the TfL

²⁴ TfL call this a joint bid, but we avoid this terminology which is confusing in the auction theory context.

website to calculate the updated contract price in the years after the initiation of the contract.

3.2 Descriptive statistics on tenders and contracts

Operator market shares in London have varied over time. The evidence collected shows that contracts have changed hands, new companies have entered the market and existing companies have exited it. The position as at October 2014 is given in Table 2.

Table 2: Market share percentage calculated according to number of buses in operation on TfL routes. <http://www.londonbusroutes.net/garages.htm>. Retrieved October 2015

| Operator | Market share |
|-----------------|---------------------|
| Go-Ahead | 24.68 |
| Metroline | 18.00 |
| Arriva | 17.75 |
| Stagecoach | 14.04 |
| RATPDev | 11.45 |
| Abellio | 7.60 |
| Transit Systems | 5.07 |
| Others | 1.41 |

Of the operators listed here, Go-Ahead, Arriva and Stagecoach are amongst the “big five” bus operators in Great Britain, with substantial operations outside London. Stagecoach left the London market in 2006 but returned in 2010. The other two of the “big five” national bus operators, First and National Express, have both operated in London but currently neither runs buses in London, for reasons connected more with overall company strategy than performance in the London market.²⁵ Arriva is now a subsidiary of Deutsche Bahn. The remaining substantial operators are all subsidiaries of overseas transport groups; Metroline is a Singaporean company, RATPDev is a subsidiary of the company operating the Paris Metro, amongst other things, Abellio is a subsidiary of Ned Rail, the Netherlands operator and Transit Systems is an Australian company. In addition, it is noteworthy that very small operators are able to survive within the system. There have been various other operators active at one time or another, commonly on outer-London routes, and for a while TfL formed its own in-house operation, East

²⁵ None of the big 5, incidentally, is headquartered in London or the south east of England.

Thames buses, following the collapse of a previous operator in 1999 (and another in 2002), but in 2009 this operation was sold to Go-Ahead.

Because the basic data on contract awards is public, and has remained essentially unchanged, we can make comparisons over time. At any one time, there are around 500 different bus routes within London. We have collected data on all the contracts awarded between early 2003 and mid-2015. Within this period, most of the contracts have been let twice, some three times, so that we can compare the contract outcome for bus service 2 (for example) at two distinct time points. Not all services are covered by this, because some exist only for a period and a very small number involve different contract arrangements.²⁶ In total, we have collected 402 instances of routes for which the contracts have been let again within our sample.

Our initial analysis of these contracts provides the following findings:

The existing company quite frequently wins the contract. Of the 402 contracts, on a narrow definition there are 194 that are won by a company with the same name. Further, names change, and including routes that are won by the same underlying company but a different division, or under a name that has changed following reorganisation, there are approximately 300 contracts won by the same company when the contract is re-tendered.²⁷ Table 3 shows more detail. In other words almost 75% of the routes go to the same entity in two successive tender rounds.

Table 3: Winning Company

| Second tender winner company | N. of contracts awarded | Percentage |
|------------------------------|-------------------------|---------------|
| Same Company | 194 | 48.26 |
| Different division/name | 106 | 26.37 |
| Different Company | 102 | 25.37 |
| Total | 402 | 100.00 |

²⁶ We decided against including bus services with numbers in the 600s, and these figures ignore that particular category of contract. These are almost all school travel services, so are run once in the morning and then again late afternoon, to coincide with the school day, rather than being a regularly timed service. In addition, some services run on a 24 hour basis whilst others have a separate “night” element (so maybe four or five services on a typical day, between 1am and 5am). In the latter case, we do not include the night route separately in our analysis.

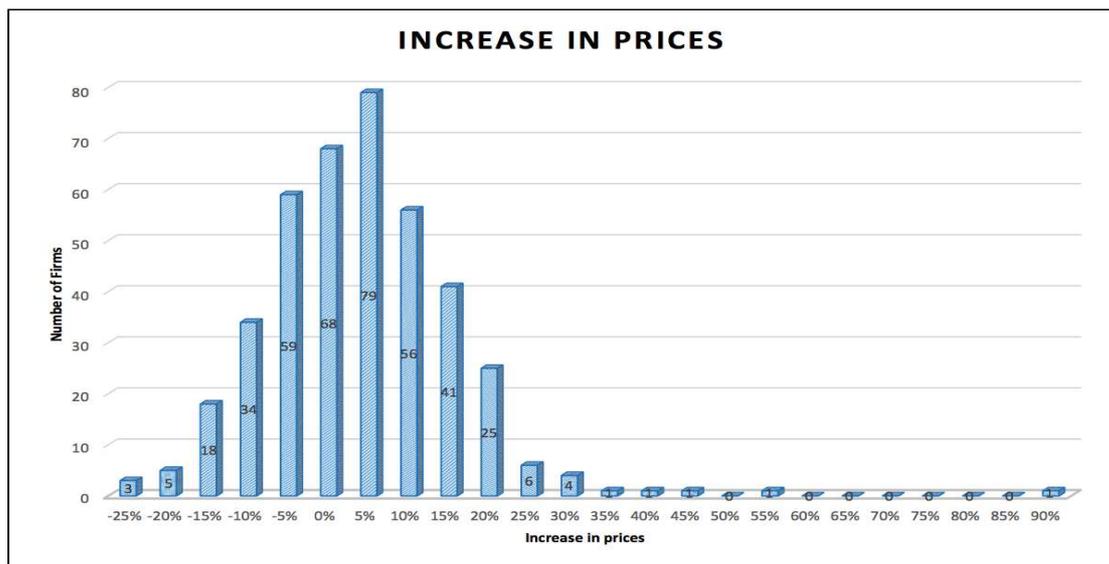
²⁷ By constructing company histories from various sources including the companies themselves, we attempted to discover whether, at the time of the tender being awarded, the winning company was in fact essentially the same company as previously held the contract. This is occasionally difficult, because companies have left and re-entered the market, for example.

The average number of competitors per contract has decreased slightly, although at 2.85 per re-tendered contract route, there are almost as many as for the first contract we observe (3.03 per route). Nevertheless, there are only 16 instances in which the re-tendered route has only one participant, which is lower than on the first occasion that we observe the contract for that route being tendered. Of the 402 routes, 120 have more competitors on the later occasion compared with the earlier one and 150 have fewer.

There is relatively little evidence for the possibility that a semblance of competition is being maintained by companies putting in “sham” bids. There are some round-number bid amounts, but these do not constitute a high proportion of the total bids that are revealed- see section 4.

The award cost (price) per mile increases over time. We compared the cost per mile implied by the contract on the second occasion of tendering that route, with the cost per mile on the first occasion, uprated to the second date according to the formula for cost increases. There is some tendency for the cost per mile to increase when the contract is let for a second time. Of the 402 cases, 253 show a rise in cost per mile above what might be anticipated if the price were generated by the cost-based formula, the remainder below that. On average in our sample, price rises by 3.8% above what might be expected from the cost-based formula. The distribution is illustrated in Figure 1 below, which shows the range of outcomes within our sample. Discounting outliers, which probably correspond to special cases of greatly changed services, the modal increase is in the tenth percentile range.

Figure 1 Price Increase over Time



Price Increase and Entry. We investigated whether the greatest price increases were observed when a new firm won the market rather than when the contract was allocated to the incumbent firm. This initial evidence goes against some previous work showing that entrants typically win auctions at lower costs than incumbents. Indeed, we find that the greatest price increase was observed when new entrants win the tender (4.20% price increase rather than 3.41%). However, we caution against putting weight on this finding, since the differences are insignificant at normal levels on a t-test (t value 0.71) and this omits controls for other factors. Rather, there is no evidence that new entrants winning was associated with a materially different cost value.

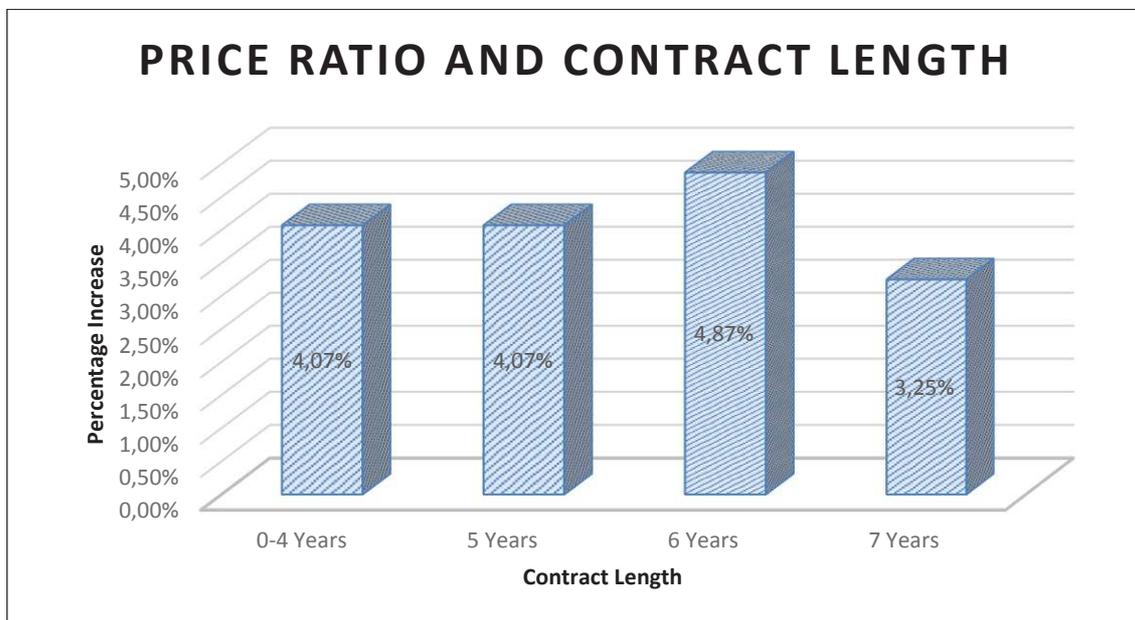
Package bidding is associated with a lower price increase. We note that the price increase (2.1%) when bids are awarded as a package to the same company tends to be lower than the price ratio when bids are allocated to individual companies (6.7%). This suggests that there may be some economies of scale/scope in the market, which make it efficient to manage more than one route in the package at the time. (Cantillon and Pesendorfer, 2006, explore this issue to some extent.).

When investigated further, the analysis confirms that greatest price increases are observed when there was package bidding initially but the contract was allocated to different firms subsequently, and that the lowest price increase are observed when there joint bidding both initially and subsequently.

Price Ratio and Contract Length. We investigated whether the price change was somehow associated with the contract duration. A contract duration of 7 years normally implies that new buses are bought at the beginning of the contract, so this should be associated to the greatest level of symmetry between the entry cost of incumbents (i.e. firms who were previously serving that route) and entrants. From Section 2.4, we should then observe that it is easier to maintain competition over time. With a 7 year contract of the sort described above, both the entrants and the incumbents will need to buy new buses to be able to provide the service.

We are only able to investigate this phenomenon to some extent because we have completed lengths only for the first contract. The raw percentages are given in figure 2. Note that contracts lasting for fewer than five years are unusual, and often are associated with particular circumstances, such as when a firm decides for strategic reasons to exit the London market. The evidence in Figure 6 suggests that contract duration is associated with different levels of price increases. However, when we run a t-test, we found that the observed difference between the sample means is not enough to say that the average price increase is significantly different (t value 0.74).

Figure 2: Price Ratio and Contract Duration



4 Regression

4.1 A summary regression

The discussion above can be crystallised through a descriptive regression analysis in which the dependent variable is the price per mile in the new contract as a ratio of the inflation formula updated price per mile in the old. That is, the updated price per mile is taken as the counterfactual contract price if things remain unchanged. Several alternative formulations, incorporating broadly the same set of right hand side variables, were tried and one of these is listed in Table 4. The rhs variables are: the ratio of the number of competitors in the new contract to the number in the year in which the contract was previously let; whether the first contract was extended to seven years; whether the contract was joint with other routes (there are three cases, joint first time not second time, joint second time not first, and joint both times); whether the same company won the route on both occasions; whether there was a single bid the second time and it was the same company as before; whether the highest bid (in cases with

more than one bid) was rounded;²⁸ the year in which the contract was let the second time;

The reasoning behind these variables is as follows.

(i) Clearly, we would expect from auction theory that if the number of bidders goes down, the price would be relatively high. It might be objected that the number of bidders is endogenous, but here we are not doing a cross section of number of bidders but rather a cross section of differences in the number of bidders for the same route over time.

(ii) Companies are commonly offered the choice of whether to extend a five year contract to seven years, on the same terms (but uprated according to the formula). We might expect that if the company chooses to extend the contract, they must think it a good deal, so the likelihood is that the rebid price when the contract comes up for renewal after seven years will be lower.

(iii) Presumably the purpose of allowing joint bids is to generate possibilities for lower average procurement costs. However, it is not clear whether companies will always be in a position to take advantage of this. We would expect that if the previous bid was not joint, then the new bid will tend to be relatively low priced if it is joint. Whether or not the other two cases will have an impact is unclear, but we might expect that if the previous bid was joint and the current one is not, the price is unlikely to be lower in the new bid.

(iv) If the same company wins a second time then there are several reasons why the price is likely to be lower than otherwise. One is that the company may be able to reuse current fleet and garage location most easily. Another is that the company is keen to hold on to the contract. On the other hand, there are also reasons why the price might be higher, for example the company may feel confident it can win again, or may believe it faces little or no opposition.²⁹

(v) Given this last point, if it is the same company and it is the only bidder, it may have felt there was no opposition regarding that particular contract;

(vi) There is also a question whether some of the bids might be sham bids, designed to indicate there is competitive bidding when there is not (Porter and Zona, 1993)- if the

²⁸ Recall that TfL publishes the value of the highest bid in addition to the value of the lowest bid and the value of the winning bid (if different).

²⁹ There is even the possibility of collusion to keep to particular routes, but the evidence for this is slight.

high bid is a round number, here taken as a sum ending in three zeros, this might indicate that the bid is not serious and

(vii) Finally, the contract regime can change from time to time for many reasons- it may become less or more competitive overall, specifications for buses may be updated, new legislation may affect costs of operation, compensation formulae may be too generous, or not generous enough. Therefore we include a year counter to capture these various effects over time.

Table 6 contains the results for a representative case. Here the dependent variable is whether or not the price in the second contract was higher, after allowing for the inflation formula, than in the first, using all 402 observations. A probit regression is employed and the coefficients reported are the marginal effects (or, in the case of dummies, the discrete change). The key variables where we anticipated a definite sign yield the expected results: more competitors lead to a lower price, the contract following a seven year contract leads to a lower price and moving from non-joint to joint bid leads to a lower price per mile. All these are comfortably significant.

On the other hand, it is somewhat surprising that having package bids on both occasions leads to a lower price on average in the second case. Of more concern from the policy point of view are the findings that if the same company wins on both occasions, the second price is higher on average other things equal (contrary to the uncontrolled result earlier), and that prices are on average rising over time, all other variables equal. As said, there are several reasons for the latter finding, and it would be useful to investigate this more deeply. Nevertheless, when the same company wins and it was the only bidder, this does not have an impact on the outcome. Moreover, there is no evidence that when the highest bid was rounded, the price is relatively high.

Table 4: Regression to investigate the determinants of whether contract prices rise or fall over time

| <i>Probit regression: Dependent is probability that the second contract is at a higher price per mile than the first.</i> | | | |
|---|------------------------|--------------------|------------------|
| Variable | Marginal effect | z statistic | Sig level |
| Bidders-new/bidders-old | -0.127 | -2.86 | 1% |
| Contract 7 | -0.147 | -2.41 | 5% |
| Non-package, package | -0.220 | -2.18 | 5% |
| Package, non-package | -0.058 | -0.66 | Non |
| Package on both occasions | -0.179 | -2.48 | 5% |
| Same company | 0.131 | 2.44 | 5% |
| Same company single bid | -0.228 | -1.52 | Non |
| High bid rounded | -0.058 | -1.03 | Non |
| Year 2009 | 0.136 | 1.23 | Non |
| Year 2010 | 0.172 | 1.7 | Non |
| Year 2011 | 0.283 | 2.91 | 1% |
| Year 2012 | 0.341 | 3.73 | 1% |
| Year 2013 | 0.352 | 3.96 | 1% |
| Year 2014 | 0.364 | 3.96 | 1% |
| | | | |
| 402 observations | | | |

4.2 Robustness

We also engaged in various alternative formulations, to check robustness. First, we performed a logit estimation. Second, we made minor modifications to the variable structure. For example, we used as an alternative dependent variable the factors that lead to the ratio of new to old price exceeding 1. Third, and perhaps most important, we examined robustness from the viewpoint that the route would only become part of the

sample if the peak vehicle requirement (PVR) for that route on the second occasion was similar to that on the first occasion. We chose two alternatives here. One drops all cases where the PVR on the second occasion is outside the range of 0.8 and 1.2 times the PVR on the first occasion. This led to there being only 363 observations. The second alternative drops those cases outside the range 0.8 to 1.2 only if this implies a difference in PVR of more than two buses. Being less restrictive, this leads to there being 373 observations. None of these alternative formulations led to results qualitatively different from the ones reported in Table 4, so we do not report them here.

We also examined the reasons for the route not to be awarded to the lowest price. For the most part, the tender for a route is offered by TfL to the bidder tendering the lowest overall “price” (bid for a year’s service as specified in the contract). However, other criteria do come into play. We investigated all tenders between 2003 and 2015 for all routes except those in the 600s series and night routes, to analyse the extent to which and reasons why the tender is offered to a firm at a price above the lowest bid. The key results of our analysis are listed in Table 5.³⁰ Of course, this is only relevant for tenders where there is more than one bidder. As is well known, “joint bids” (we prefer the term “package bids”) are a major reason, since the package is chosen if overall across the routes packaged together by the bidder, the contract price is lower, and we allow for that in our analysis.³¹ Quality is also of relevance, and the bidder needs to convince TfL that it offers acceptable quality in terms of keeping to schedule and maintaining the fleet at a high standard. However, in 5% of cases the incumbent is rewarded for high performance in the past by being offered the tender. For some reason, this was particularly prevalent in 2008, with over 30 cases, that is over 50% of the total, in that year. We consider the possible importance of this below.

³⁰ There are a few other cases where for a variety of reasons the lowest bidder was not offered the tender, but none of the reasons given covered as many cases as those in the table below. Note this is a more inclusive sample than in the main regressions, because the focus is the individual contract.

³¹ See Cantillon and Pesendorfer (2006) for a more extensive analysis of package bidding.

Table 5: Analysis of contracts where the lowest cost tender did not win

| | Number | % | |
|------------------------------------|--------|------|-------|
| Cases with more than one bidder | 1065 | 100 | |
| Reasons for not awarding to lowest | | | |
| Joint bid is lower cost | 153 | 14.4 | |
| Higher quality expected from award | 64 | 6.0 | |
| Incumbent past good performance | 53 | 5.0 | |
| | | | |
| Incumbent cited in | 53 | | cases |
| of which, in 2008 | 30 | | |

We conclude by noting that we cannot exclude that the increase in prices over time is explained by improvements in quality performance. However, returning to table 1, statistics produced by TfL seem to suggest that bus performance over the relevant years has not changed dramatically. On the one hand, total bus mileage has been rising by around 1% per year. Passenger numbers have grown more rapidly, perhaps 2.6% per year on average, although the total impact is more difficult to judge given the double rebasing of the figures during the period. The implication is that buses will have become a little more crowded over the years and dwell times at bus stops will have increased, which could have increased costs, but perceived bus quality has increased: customer satisfaction has been rising and objective measures of quality have been maintained.

5 Conclusions

We argue that where recurrent contracts for the same service are envisaged, significant thought needs to be given to the implications for those tender rounds subsequent to the initial tender. Our analysis of the evolution of competition in the market for bus services in London suggests that the bus service procurer, TFL, thought carefully how to design tenders. It has chosen relatively small contracts, high tender frequency, small lot sizes compared with the size of the market, and a large degree of transparency to improve knowledge about the key cost drivers behind the staggered nature of the contracts. Coupled with a market that was split between several operating units and with the geographically dispersed nature of their operators, this may have helped in sustaining some competition over time.

However even here, there is some suggestion that tender performance and outcomes are worsening slightly, with higher prices being observed over time. Whilst we cannot be sure this is a sign that competition is fading, we cannot rule it out either. The predictions of economic theory that there may be learning effects, sunk cost asymmetries, and activism effects, as the incumbents win significantly more often than entrants, seem relevant. Taken together, these factors may be pushing for some reduction in competition over time, as signalled by the slightly declining number of firms and especially by the increasing average contractual price relative to Tfl's index. The alternative explanation is that winning bid prices are rising due to increases in average quality, with later generations of buses being better equipped than earlier ones. However, as service quality is only reported on an annual basis and past data is scarce, more data would be needed to quantify the impact of service quality.

References

- Amaral, M. Saussier, S. and A. Yvrande-Billon (2009), Auction Procedures and Competition in Public Services: The case of Urban Public Transport in France and London, *Utilities Policy* 17, 166–175.
- Amaral, M. Saussier, S. and A. Yvrande-Billon. (2013), Expected Number of Bidders and Winning Bids: Evidence from the London Bus Tendering Model, *Journal of Transport Economics and Policy*, 47 (1): 17-34(18)
- Anton, J. and D. Yao, (1987). Second Sourcing and the Experience Curve: Price Competition in Defense Procurement, *RAND Journal of Economics*, 18(1): 57-76
- Belleflamme, P. and M. Peitz, (2015). *Industrial Organization: Markets and Strategies*, Cambridge, Cambridge University Press.
- Cantillon E. and M Pesendorfer (2006). Auctioning Bus Routes: The London Experience, Ch. 23 in Cramton, Shoham and Steinberg (eds), *Combinatorial Auctions*, MIT Press.
- Chong, E., Stéphane S., B S. Silverman (2015), Water Under the Bridge: Determinants of Franchise Renewal in Water Provision, *Journal of Law, Economics and Organization*: 31 (1), 3-39.
- Cowan, R. (1990), Nuclear Power Reactors: A Study in Technological Lock-in. *The Journal of Economic History*, 50(3), 541-567.
- Dana J. and K. Spier (1994) Designing a Private Industry: Government Competition with Endogenous Market Structure, *Journal of Public Economics* 53, 127-147.
- De Silva, D.G., Dunne, T., Kosmopoulou, G., (2002), Sequential Bidding in Auctions of Construction Contracts. *Economics Letters* 76(2), 239 -- 244
- De Silva D., Dunne T., Kosmopoulou G. (2003) An Empirical Analysis Of Entrant And Incumbent Bidding In Road Construction Auctions. *The Journal of Industrial Economics* 51(3): 295--316.
- De Silva, D.G., Kosmopoulou, G., Lamarche, C., (2009). The Effect of Information on the Bidding and Survival of Entrants in Procurement Auctions. *Journal of Public Economics* 93(1-2), 56-72.

De Silva, D., Kosmopoulou, G., Lamarche, C. (2012) Survival of Contractors with Previous Subcontracting Experience , *Economics Letters*, 117(1), 7–9.

Farrell and Klemperer P. (2005), Coordination and Lock-in: Competition with Switching Costs and Networks Effects', in M. Armstrong and R. Porters Handbook of Industrial Organization, Elsevier Publishing.

Iossa, E. Rey, P. and Waterson M. (2016), Maintaining Competition in Procurement When Activism Matters. University of Rome Tor Vergata, Mimeo.

Jofre-Bonet M., Pesendorfer M. (2000) Bidding Behavior in a Repeated Procurement Auction: A Summary. *European Economic Review* 44: 1006--1020.

Jofre-Bonet M., Pesendorfer M. (2003) Estimation of a Dynamic Auction Game, *Econometrica* 71: 1443--1489.

Kennedy, D. (1996), London Bus tendering: a Welfare Balance. *Transport Policy*, 2(4): 243-249.

Klemperer, P. (1995), Competition When Consumers Have Switching Costs, *Review of Economic Studies* 62: 515-539.

Lewis, T. and H. Yildirim, (2002). Managing Dynamic Competition, *American Economic Review*, 92(4): 779-797.

Li S. and Philips P., (2012) "Construction Procurement Auctions: Do Entrant Bidders Employ More Aggressive Strategies than Incumbent Bidders?", *Review of Industrial Organization*, 40(3): 191-205.

Mattera, G. and Zampino, R. (2015), What causes Incumbency Power in Scoring Auctions? Evidence from the Procurement of ICT services, mimeo, University of Rome Tor Vergata.

Saini, V. (2012) Endogenous asymmetry in a dynamic procurement auction, *Rand Journal of Economics*, 43: 726-760.

SMMT (Society of Motor Manufacturers and Traders), (2010). Bus longevity report, London.

Verbich, D. and El-Geneidy, A. (2016), The pursuit of satisfaction: Variation in satisfaction with bus transit service among riders with encumbrances and riders with disabilities using a large-scale survey from London, UK, *Transport Policy*, 47(1): 64-71.

Williamson, O. E. (1976) Franchise bidding for natural monopolies: In general and with respect to CATV, *Bell Journal of Economics* 7(1), 73-104.

Williamson, O.E. (1981) The economics of organization: The transaction cost approach, *American Journal of Sociology*, 87: 548-577.

Zupan, M.A. (1989) Cable franchise renewals: Do incumbent firms behave opportunistically? *RAND Journal of Economics* 20(4), 473-82.

RECENT PUBLICATIONS BY *CEIS Tor Vergata*

Theory and Practice of TFP Estimation: the Control Function Approach Using Stata

Vincenzo Mollisi and Gabriele Rovigatti
CEIS Research Paper, 399, February 2017

When multiple merged entities lead in Stackelberg oligopolies: Merger paradox and Welfare

Walter Ferrarese
CEIS Research Paper, 398, February 2017

Representation, Estimation and Forecasting of the Multivariate Index-Augmented Autoregressive Model

Gianluca Cubadda and Barbara Guardabascio
CEIS Research Paper, 397, February 2017

The “Double Expansion of Morbidity” Hypothesis: Evidence from Italy

V.Atella, F.Belotti, C.Cricelli, D.Dankova, J.Kopinska, A.Palma and A.Piano Mortari
CEIS Research Paper, 396, February 2017

The *baraccati* of Rome: internal migration, housing, and poverty in fascist Italy (1924-1933)

Stefano Chianese
CEIS Research Paper, 395, February 2017

Optimal Monetary Policy in a Pure Currency Economy with Heterogenous Agents

Nicola Amendola, Leo Ferraris and Fabrizio Mattesini
CEIS Research Paper, 394, December 2016

A Closer Look at EU Current Accounts

Mariarosaria Comunale
CEIS Research Paper, 393, August 2016

The Effect of the Italian Unification on the Comparative Regional Development in Literacy, 1821-1911

Carlo Ciccarelli and Jacob Weisdorf
CEIS Research Paper, 392, July 2016

A Vector Heterogeneous Autoregressive Index Model for Realized Volatility Measures

Gianluca Cubadda, Barbara Guardabascio and Alain Hecq
CEIS Research Paper, 391, July 2016

The Corporate Legality Game. A Lab Experiment on The Impact of Policies, Frames and Information

Leonardo Becchetti, Vittorio Pelligra and Fiammetta Rossetti
CEIS Research Paper, 390, July 2016

DISTRIBUTION

Our publications are available online at www.ceistorvergata.it

DISCLAIMER

The opinions expressed in these publications are the authors' alone and therefore do not necessarily reflect the opinions of the supporters, staff, or boards of CEIS Tor Vergata.

COPYRIGHT

Copyright © 2017 by authors. All rights reserved. No part of this publication may be reproduced in any manner whatsoever without written permission except in the case of brief passages quoted in critical articles and reviews.

MEDIA INQUIRIES AND INFORMATION

For media inquiries, please contact Barbara Piazzi at +39 06 72595652/01 or by e-mail at piazzi@ceis.uniroma2.it. Our web site, www.ceistorvergata.it, contains more information about Center's events, publications, and staff.

DEVELOPMENT AND SUPPORT

For information about contributing to CEIS Tor Vergata, please contact Carmen Tata at +39 06 72595615/01 or by e-mail at segr.ceis@economia.uniroma2.it