

# Bidding for urban public transport: an econometric analysis of French competitive trends\*

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*Preliminary and incomplete*

## Abstract

Urban public transport services are delivered in France through the use of competitive tenderings, with firms participating in city-specific auctions. The market has been formerly described, based on pre-2005 data, as a failure of liberalization, with a large incumbency bias and with little competition. This paper studies the recent trends in competition on this market by using a detailed database at the firm level. We find that, after 2005, competition significantly strengthened, with auctions attracting more bids and a decreasing rate of renewal for incumbents. In addition to this market overview, we study the determinants of participation and success in auctions.

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**Keywords:** transportation, auctions, public-private partnerships.

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# 1 Introduction

Private provision of public services has been on an upward trend, with many governments pushing for the introduction of competitive tendering in various sectors of the economy. The European Union itself is promoting public private partnerships as an efficient way of delivering public goods at a low cost. However, it is argued that these arrangements may fail to implement an efficient outcome. In particular, it is feared that auctions may not improve efficiency but rather foster collusion among a very small number of dominant firms. The French urban public transport market is thought to be a case in point.

Economists (see the different works by Amaral, Saussier, and Yvrande-Billon) repeatedly documented the remarkably stable market shares of a few operators and the large incumbent bias. These hinted market forces were not efficiently at play. On the other hand, these studies focused on a period that ends, at the latest, in 2006. Little is known about the later years, and that constitutes a first motivation for our paper. Various reasons may lead us to expect that the market has significantly evolved since 2005-2006. First, the French Council of Competition fined in 2005 the three main operators on this market for collusive strategies.<sup>1</sup> Regardless of the final outcome of the legal procedure, it suggests the market in 2005 must have then been characterized by some inertia. It may have been succeeded by greater dynamism, when new firms started to enter, or when existing firms started to become more aggressive towards their competitors. A second motivation relates to improved data collection. Former studies relied on datasets that, for each auction, identified the incumbent and the winner of the auction. However nothing was known about the number of firms that bid, or their identity, significantly restricting the analysis of competition on the market. We overcome this constraint by collecting data on all the firms that bid in each auction. We therefore obtain a more complete picture of the market which allows us to delve into its functioning. A final motivation is to analyse the mechanisms at play in the urban public transport auctions.

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<sup>1</sup>This decision has been appealed by these firms and is still pending.

The data collected is exploited to study the determinants of participation in auctions, and of the probability of winning them. Taking into account selection bias in participation, we find insights, uncovered so far, on firms' behaviours on this market.

## 2 Data

The dataset spans the years 2004-2010. For each auction, it contains the identity of the incumbent, of bidding firms, and of the winning firm. Characteristics of the type of service are also present: size of the transport network (in km), number of trips per inhabitant, city name, and duration of the contract. In addition, each firm is characterized by the number of networks it operates in order to account for economies of scale. 204 auctions are included. Table 1 presents the summary statistics of the variables used in the econometric analysis.

Table 1: Summary statistics

Variable	Mean	Standard deviation
Duration	6.51	2.83
Log kilometers	6.80	1.51
Log population	4.08	1.11
Trips per inhabitant	0.04	0.04
Right-wing mayor	0.57	0.5
Veolia incumbent	0.27	0.45
Keolis incumbent	0.36	0.48
Transdev incumbent	0.09	0.29
Number of networks	29.4	26.5

## 3 Descriptive statistics

Figure 1 reports the evolution of the replacement rate, i.e. the proportion of auctions where the incumbent is replaced by a competitor. In 2004-2005, the incumbent virtually always won the auction. This is much less the

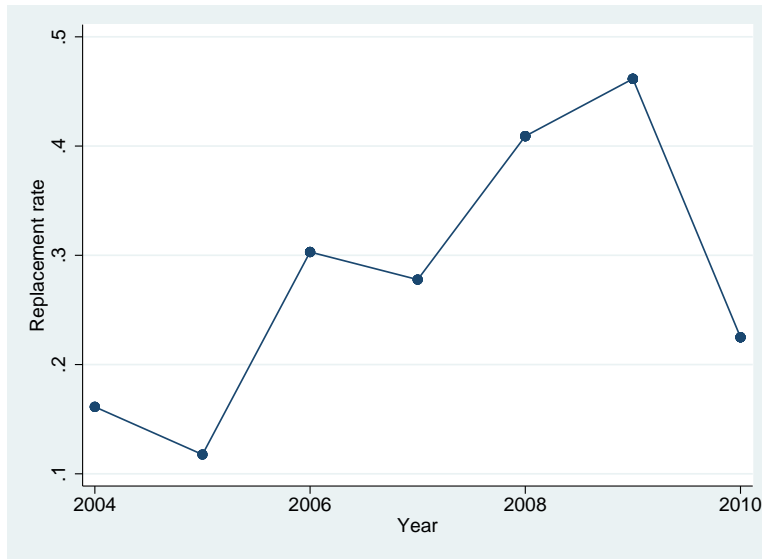


Figure 1: Replacement rate, 2004-2010

case in more recent years when the probability of not being reconducted is close to 40 percent. The sharp fall in the replacement rate in 2010 is difficult to interpret at this stage. Given the increasing trend in non-renewal, incumbent firms may not take renewal for granted and may have started to invest more efforts in securing it. 2010 may reflect these increased efforts. On the contrary, it may be a reversal in the competition level.<sup>2</sup> Figure 2 suggests otherwise.

It plots the average number of bids per auction. Auctions have attracted more bids over time, and there is no significant trend break in 2010. The lower replacement rate in 2010 is not due to firms not bidding, but due to a higher rate of success for incumbents, which in itself does not necessarily indicate a weakening of competition, but rather points at the improved efficiency of incumbents.

Figure 3 also confirms the trend in competition. It reports the proportion of auctions that did not attract any bid other than the incumbent's. In 2004,

<sup>2</sup>2010 was also an unusual year as the sector was waiting for the decision of the French competition authorities regarding the merger between Veolia Transport and Transdev.

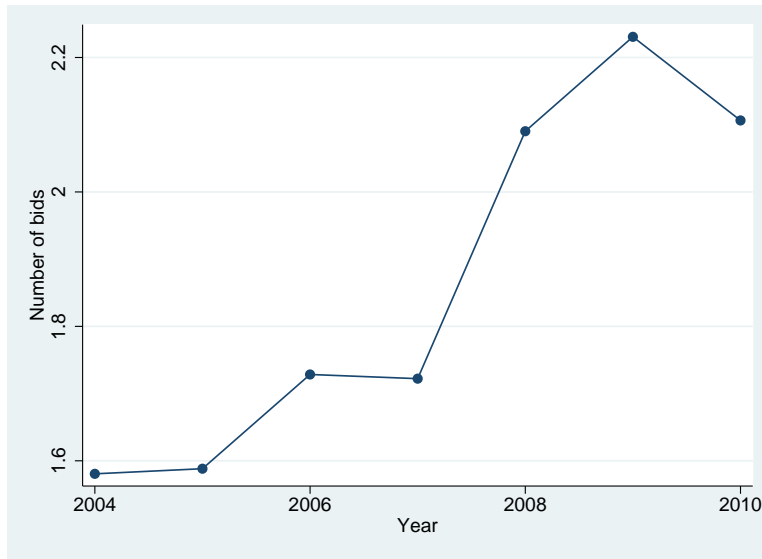


Figure 2: Number of bids, 2004-2010

close to 65 percent of the auctions occurred without any competition among operators. In 2010, this proportion was of 22.5 percent. This dramatic drop reflects a complete change of strategy by the urban transport firms on the French market. Figure 4 dwells on that particular point by showing the proportion of auctions where the firm is not the incumbent and participates to the auction. For instance, Keolis in 2004 took part in only 10 percent of the auctions where it was not the incumbent. It did so in 50 percent of the auctions in 2009. As is apparent from Figure 4, the leading firms (Keolis, Transdev, Veolia) became much more aggressive after 2004. They started to bid for many more public transport markets than they did in 2004-2005, when they essentially focused on renewing incumbent contracts. This trend is also observed for independent operators. These are city-specific, but grouped together in Figure 4. Independent operators enter auctions that they used to neglect, and that also reinforces competition. Ratp Dev. is a new entrant on the market, and has publicly expressed its willingness to challenge the main operators. Although little can be said about its future prospects using Figure 4, it confirms its intentions by showing a dramatic

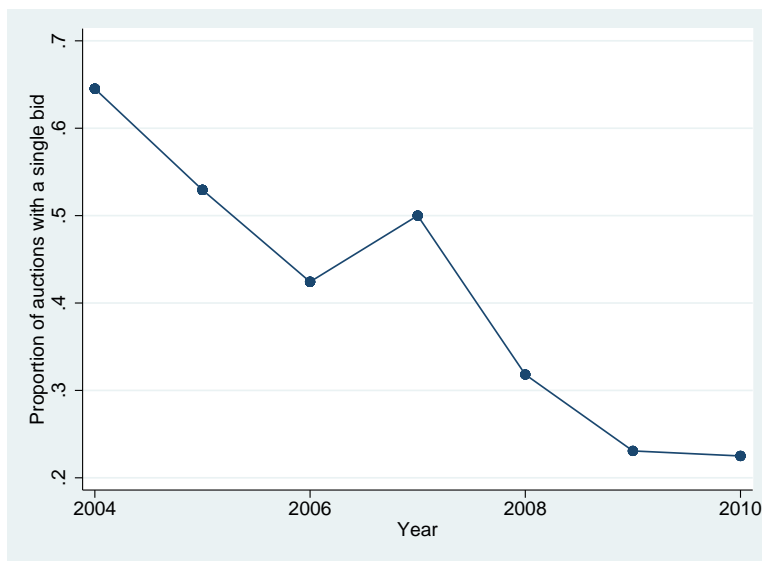


Figure 3: Proportion of auctions with a single bid, 2004-2010

increase in its participation rate. Carpostal and Vectalia are two minor firms that usually participate in two or three auctions per year.

These descriptive results point at a significant evolution towards more competition on the French public urban transport markets. Existing operators have become more aggressive by bidding in many cities. At the same time, smaller operators also started to challenge the dominance of the largest firms.

## 4 Participation and success in auctions

### 4.1 Estimation strategy

Section 3 describes a strengthening of competition on the French urban transport market. This conclusion remains preliminary at this stage as it is unclear what determines participation and success in auctions. For instance, firms may compete more fiercely for large cities. If these contracts were auctioned in the later years of our sample, then the observed trend may be due more to city size than to competition in itself. This section

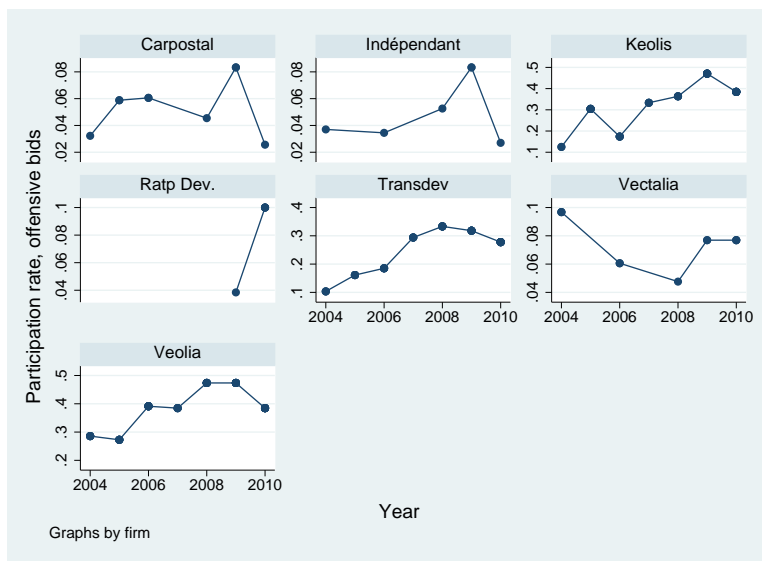


Figure 4: Participation rates as an offensive bidder, by firm, 2004-2010

estimates these determinants not only to avoid this erroneous conclusions, but also to better understand the mechanisms at work on the market. Little is known about the factors that affect participation in auctions, and this section contributes to this goal.

Having information on firms' participations to auctions allows us to estimate the determinants of their participation in auctions. We can evaluate the effects on participation of the characteristics of the contract, the city, and the identity of the incumbent. Data was also collected on the party affiliation of the mayor at the time of the auction, in order to test for an ideological bias. A probit model with a discrete indicator of participation as the dependent variable is estimated. In a similar fashion, a Poisson regression is used to find the determinants of the number of bids in an auction.

The second step of our analysis looks at the variables that influence success to an auction. Because participation to an auction is not random, it is important to take into account the potential selection bias that affects estimation at this stage. The participation equation therefore serves as the first step of a Heckman probit in order to control for selection bias.

More specifically, two equations are estimated. The first one is the participation equation, of interest in itself, and the second one is the success equation, estimated jointly with the participation equation. When only participation is investigated, equation (1) is estimated:

$$p_{ij} = 1 [\mathbf{x}_{ij}\boldsymbol{\beta} + u_{ij} > 0] \quad (1)$$

where  $p_{ij}$  takes the value 1 if firm  $j$  bids in auction  $i$  and  $\mathbf{x}_{ij}$  is a vector of independent variables. Estimation of the success equation uses the participation equation as a sample selection equation.

$$\begin{aligned} p_{ij} &= 1 [\mathbf{x}_{ij}\boldsymbol{\beta} + u_{ij} > 0] \\ s_{ij} &= 1 [\mathbf{z}_{ij}\boldsymbol{\delta} + v_{ij} > 0] \end{aligned} \quad (2)$$

This binary response model with sample selection provides consistent estimates of success determinants. Variables in  $\mathbf{z}_{ij}$  include incumbency, number of competitors, number of networks operated by the firm, but not the city/contract characteristics: conditional on participating, the duration of the contract, for example, does not affect the probability of winning the auction. That provides us with the necessary exclusion restrictions to estimate (2).

## 4.2 Results

### 4.2.1 Participation in an auction

Table 2 presents the results of three probit regressions on participation to auctions in the first three columns.<sup>3</sup> The fourth column reports the results of a Poisson regression with the number of bids as the dependent variable. In column (1), only contract specific variables are included. Duration of the contract and city population do not significantly affect participation, but the number of trips per inhabitants does. The size of the network also matters, with large ones attracting more participants, but the effect is only weakly significant. Political ideology seems to be taken into account and the

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<sup>3</sup>Incumbents always bid, such that they are not included while estimating equation (1).

effect is economically relatively large: a change from a left wing to a right wing mayor increases the participation probability by 6.8 percent.<sup>4</sup> The number of trips per inhabitant also influences participation, with a high ratio discouraging participation. It could be an already well-functioning network, with relatively little room for improvements, and so a higher reconduction probability.

In column (2), the number of networks operated by a firm the year before the auction is added as an independent variable. It captures economies of scales, but also the credibility of a well-known operators. On the other hand, it may be interpreted as a sign of dominance. At this stage, it is impossible to distinguish between efficiency and anti-competitive interpretations. The coefficient is statistically very significant but its size is quite modest. An additional network only increases the participation probability by 0.38 percent. In column (3), incumbency fixed effects for the three main firms are controlled for. The omitted category is incumbents that are neither Keolis, nor Transdev, nor Veolia. The three fixed effect coefficients are negative, but only a Veolia incumbency is associated with lower participation. The fact that the coefficients are negative was expected: when the omitted category is the incumbent, participation is likely to be high because the challengers are firms that participate very often. If, on the contrary, Veolia is the incumbent, the potential challengers are firms that, as a group, participate rarely. As a consequence, the coefficients hardly say anything about firms being discouraged by Veolia, but rather underline that Veolia has a higher participation probability than other firms. The absolute coefficients have little interest in themselves, but their relative sizes are more instructive. In particular, Keolis and Veolia are similar in size and the coefficients on their incumbency variables are only statistically different with a  $p$ -value of 6.8 percent. That suggests Veolia is slightly more aggressive than Keolis, but only with a somewhat low confidence level. Finally, the year dummies in columns (1) to (3) confirm that firms became more likely to participate in an auction over time. They also fail to reject that 2010 is statistically different from 2009: the drop in replacement rates in Figure 1 is not due to falling

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<sup>4</sup>All presented marginal effects are average marginal effects.

participation.

In column (4), the dependent variable is the number of bidding firms. Results from the probit regressions are broadly confirmed.

#### 4.2.2 Success

Participation and success are not independent decisions. Shocks to participation, or hidden factors, are likely to also affect success, such that one cannot estimate the success probability while ignoring the decision to participate. This amounts to a selection bias, that must be taken care of. The participation equation estimated in Section 4.2.1 provides a selection equation that is now used as a first step in the estimation.

Estimation of models with sample selection typically requires exclusion restrictions, i.e. some independent variables of the participation equation should not enter into the success equation. Our assumption is that once a firm has chosen to participate in an auction, the characteristics of the contract should not matter for its success. Exclusion of duration, network size and trips per inhabitant are therefore natural and allow estimation of the model.

Table 3 first estimates the success equation without accounting for sample selection. Only two variables are included: the inverse of the number of bids, which mechanically affects the probability of winning, and an incumbency dummy variable. Results indicate that incumbents are more likely to win auctions, and that, unsurprisingly, fewer bids increase the probability of success. The effect is large: being an incumbent increases success probability by 18.5 percent. Column (2) reports the results of the estimation of the system of equations (2), which takes sample selection into account.<sup>5</sup> It is of course still the case that the number of bids affect the probability of winning the auction. However, there is no significant advantage to the incumbent. This result implies that when the incumbent faces competition, it is in no better position than his competitors. Year dummies are not significant in any of the specifications, showing the absence of year effects concerning suc-

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<sup>5</sup>The participation equation is not reported as it has already been in Section 4.2.1.

Table 2: Participation determinants

	(1)	(2)	(3)	(4)
	Probit	Probit	Probit	Poisson
Duration	0.021 (0.017)	0.023 (0.018)	0.024 (0.018)	0.016* (0.0084)
Log kilometers	0.25* (0.13)	0.23* (0.13)	0.18 (0.14)	0.095 (0.066)
Log population	-0.023 (0.16)	0.012 (0.17)	0.082 (0.17)	0.063 (0.090)
Trips per inhabitant	-5.65** (2.57)	-5.24* (2.71)	-4.88* (2.74)	-2.98** (1.49)
Right-wing mayor	0.29*** (0.11)	0.34*** (0.11)	0.36*** (0.12)	0.18** (0.070)
Number of networks, lagged		0.018*** (0.0019)	0.017*** (0.0019)	
Veolia incumbent			-0.43*** (0.16)	-0.36*** (0.096)
Transdev incumbent			-0.18 (0.20)	-0.096 (0.11)
Keolis incumbent			-0.16 (0.15)	-0.22** (0.10)
2005	0.11 (0.21)	-0.0078 (0.23)	-0.019 (0.23)	0.032 (0.15)
2006	0.42** (0.21)	0.31 (0.22)	0.26 (0.22)	0.18 (0.14)
2007	0.39* (0.23)	0.29 (0.24)	0.22 (0.25)	0.18 (0.15)
2008	0.50** (0.21)	0.45** (0.21)	0.34 (0.22)	0.32** (0.15)
2009	0.55*** (0.20)	0.54** (0.21)	0.50** (0.21)	0.39*** (0.14)
2010	0.47** (0.18)	0.46** (0.20)	0.45** (0.20)	0.36*** (0.13)
Constant	-3.05*** (0.40)	-3.65*** (0.44)	-3.33*** (0.46)	-0.40 (0.28)
Observations	907	907	907	165
Pseudo $R^2$	0.048	0.15	0.16	0.046

Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

cess. That confirms our conclusions in Section 3 that higher participation to auctions has dramatically affected competition levels. In column (3), the identity of the incumbent matters little for the probability of success, suggesting that competition is equally effective across firms. In all specifications, the number of networks operated by a firm does not affect success. This is consistent with the lack of an incumbency effect since, conditional on participating, all firms have similar chances to win the auction.

Table 3: Success determinants

	(1)	(2)	(3)
	No sample selection	Sample selection	Sample selection
Incumbent	0.66*** (0.16)	-0.044 (0.32)	-0.097 (0.36)
Number of offers, inverse	3.15*** (0.37)	3.12*** (0.37)	3.13*** (0.40)
Number of networks, lagged	0.0024 (0.0032)	-0.0028 (0.0039)	-0.0036 (0.0046)
Veolia incumbent			0.035 (0.25)
Keolis incumbent			0.013 (0.22)
Transdev incumbent			-0.028 (0.28)
2005	-0.11 (0.30)	-0.12 (0.33)	-0.12 (0.33)
2006	-0.10 (0.31)	-0.14 (0.32)	-0.14 (0.31)
2007	-0.062 (0.36)	-0.25 (0.36)	-0.24 (0.36)
2008	-0.15 (0.32)	-0.34 (0.33)	-0.32 (0.32)
2009	-0.064 (0.30)	-0.28 (0.31)	-0.28 (0.31)
2010	-0.15 (0.28)	-0.28 (0.30)	-0.28 (0.29)
Constant	-1.80*** (0.32)	-0.69 (0.58)	-0.62 (0.63)
$\rho$		-0.58** (0.28)	-0.64* (0.34)
Observations	377	377	377
$\chi^2$ , $p$ -value	2.1e-27	3.2e-14	3.8e-13

Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

The parameter  $\rho$  measures the correlation between  $u_{ij}$  and  $v_{ij}$  in (2), and so sample selection. It is statistically significant, which reinforces our concern that estimates in column (1) are biased. Table 3 underlines that, once participation determinants are controlled for, incumbents do not enjoy any particular advantage.

## 5 Conclusion

This paper, though preliminary, uncovers a number of insights on the French urban transport market. Previous studies underlined the low competition levels that characterized this market. Our study shows that dramatic changes have occurred in the last few years, and that competition is now stronger. An important contribution of the paper is its use of a dataset at the firm level, which allows examination of competition beyond the simple incumbency bias. We find that increased competition occurred through higher participation to auctions. These results call for further research to provide a robust interpretation of the effects we described.