Merger Efficiency Gains: An Assessment of the French Urban Transport Industry[1]

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Abstract

The goal of this paper is to provide an ex post evaluation of the merger that took place between Veolia Transport and Transdev in the French urban public transport industry in 2011. Our aim is to evaluate the existence and extent of efficiency gains from the merger. We apply a difference-in-differences methodology to evaluate the effect of the merger on operating costs of transport operators. We consider alternative control groups and account for various time windows. In addition, we account for heterogeneous treatment effects, depending on what contract type is in place (fixed-price or cost-plus). Our results show that the merger did not lead to any cost efficiency gains. A possible explanation for our result is that the merger proved to be problematic to implement because of the differences in culture between Veolia Transport and Transdev and the mismanagement of the operation.

Key words: Ex-post merger evaluation, Difference-in-differences, Cost efficiencies, Competitive bidding procedures.
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1 Introduction

Competition authorities study potentially problematic mergers by comparing market shares of the merging parties in the relevant market before and after the merger and by simulating, more or less sophisticatedly, potential price increases that can be expected from the merger. The result of this analysis, which tries to evaluate the potential anticompetitive effects of the merger, helps the authority decide on whether to authorize it unconditionally or conditionally on remedies or simply reject it. A growing body of research tries to evaluate ex post the impact of mergers which were almost prohibited. These ex post analyses contribute to giving feedback to competition authorities on whether their analysis, mainly of market power and potential price increases, led to the appropriate decision.

One important aspect of mergers is often overlooked, both in ex ante analysis of competition authorities and ex post analysis of researchers[4]: efficiency gains. Yet, efficiency gains are often a central aspect to the economic motivation behind a merger. It is hence interesting to know ex ante if the efficiency gains argument is convincing.

The aim of this paper is to perform an ex post evaluation of a merger among two of the three main urban transport groups in France focusing on potential efficiency gains generated by the merger. Our results show that the merger did not lead to any efficiency gains for the merging parties.

In 2009, Transdev selected Veolia Transport, to merge. This merger was approved by the French Competition Authority in 2010 with remedies and the deal was closed in 2011. The new entity, which faced one main competitor and three smaller competitors in the market, had a market share of nearly 40%.

Contrary to most industries in which efficiency gains can be potentially passed on to consumers through price decreases, the functioning of urban public transport in France is such that efficiency gains can only be passed on to taxpayers through a decrease in the subsidies received by the operator of the transport service. Urban public transport is highly subsidized; commercial revenues cover a small part of the costs of operating the service.

The sector is highly regulated by local authorities which are in charge of its organization

[4] Efficiency gains are most of the time not specifically studied in ex post analysis of mergers. However, they are included in the estimation of the effect of a merger on prices: a decrease in prices due to a merger means that efficiency gains dominate the effect of market power on prices.

at the local level. They choose to operate the service themselves or to delegate this task to a private or public-private operator. To select a transport operator, the local authority is required to launch a competitive tender procedure in which it specifies the characteristics of the service to be provided (network length, ticket fares, output, etc.). One of the main choice criterium in the relevant tenders is the level of subsidies asked by the operator to operate the service. Efficiency gains can hence be a powerful means for operators in order to succeed in tenders. At the same time, efficiency gains, if reflected in lower subsidies paid to transport operators, relax the burden on taxpayers.

The French Competition Authority focused its analysis on potential anticompetitive effects of the merger, the main concern being that the reduction in the number of competitors in competitive tenders would lead to an increase in subsidies asked by operators, as well as less innovation. It did not assess potential efficiency gains from the merger, arguing that even if efficiency gains were possible, they would most likely not be passed on to taxpayers via a decrease in subsidies. It did not consider that the change in the structure of the market could modify the incentives of the players in the market in view of potential cost efficiencies faced by the merging parties.

Our analysis of efficiency gains is based on a unique database which provides information on the characteristics of urban transport networks, as well as details related to the costs and revenues of urban transport operators in France for the years 2005-2013, that is before and after the merger. This data was further complemented by a database of competitive tenders for the choice of transport operators which took place in the period 2004-2013. In particular, it contains the identity of the incumbent operator, the identity of the winner of the tender as well as the identities of other operators that submitted offers in the competitive procedure. It enables us to identify networks relevant for control groups for our merger evaluation. In addition, we are able to provide an up-to-date analysis of the competitive intensity in the sector, which has not been done, to our knowledge, for the last 10 years.

We employ a difference-in-differences methodology to study the potential efficiency gains resulting from the merger. We take advantage of the fact that some networks were not affected by the merger. We use four different control groups to rule out the possibility of the control group being affected by the merger. The first control group is composed of all networks managed by the

three main competitors of Veolia Transport and Transdev. In the remaining groups, we account for potential spill-over effects from the merger to networks operated by rivals of the merging groups. We believe that the strategic behavior of firms, if any, could appear in competitive bidding procedures. Rivals groups could indeed have an incentive to decrease their costs in new tenders if they expected the merged entity to enjoy merger efficiency gains. In order to account for the possible strategic reaction of competitors post merger, we consider three additional control groups. Our second control group is composed of only networks in which the contract for the operation of the urban transport service in a given network was signed prior to the merger. The third control group consists only of networks where competition in tenders seems to be absent. Finally, we consider only networks in which Veolia Transport and Transdev did not submit a bid in tenders for the operation of the transport service throughout the period of our analysis. We believe that by considering the last three control groups, we overcome the potential issue of strategic behavior of the rival groups post merger.

Our results show that the merger did not lead to any efficiency gains for the merging parties. Local transport operators explain this finding by the fact that margins in the sector are extremely low and operating costs cannot be further reduced. This explanation is not entirely satisfactory. Another more compelling explanation is that the merger proved in practice extremely difficult to implement successfully because of the differences in cultures between the two entities, the numerous disagreements between the managements of the two groups and the mismanagement of the operation. The merger was indeed poorly prepared at the operational level when the deal was closed in March 2011. Consequently, the merged entity focused on problems which occurred at the group level and left local subsidiaries manage themselves on their own. Expertise sharing and the spreading of cost-savings technologies at the group level, as well as the implementation of a new culture at the local level most probably did not take place. In addition, managers were not motivated by the merger, be it at the local, regional or group level so the consolidation did not improve managerial efficiency. Since the merger was poorly prepared, we do not exclude the possibility that three years of data post-merger is not enough to detect any efficiency gains. As Focarelli and Panetta (2003) suggest, efficiency gains may take some time to occur.

This paper fits into the large literature on ex post merger evaluation. Most papers existing in the literature evaluate, however, the impact of mergers on prices (see Focarelli and Panetta

(2003), Hastings (2004), Hastings and Gilbert (2005), Taylor and Hosken (2007), Ashenfelter and Hosken (2010), Ashenfelter, Hosken and Weinberg (2013), Ashenfelter, Hosken and Weinberg (2015), Aguzzoni et al. (2015)). To our knowledge, few studies exist that evaluate cost efficiencies from mergers directly. Aschenfelter, Hosken and Weinberg (2013) look separately at the effect of increased concentration and efficiencies on prices following a merger in the U.S. brewing industry. Concentration is measured using the Herfindal Hirschman Index while efficiencies are measured as shipping distances between retailers and the nearest brewery. They show that the effect of increased concentration and improved efficiency offset each other so that prices do not increase following the merger. The main contribution is to provide direct evidence that merger-specific efficiencies influence pricing.

The contribution of our paper is to estimate potential pro competitive effects of the merger, namely merger efficiency gains. This was the main argument put forward by the merging parties to convince the competition authority to authorize the merger.

The paper is organized as follows. Section 2 presents the French urban public transport industry. Section 3 describes the merger under study. Section 4 provides descriptive statistics on the competitive intensity in the industry for the period before and after the merger. Section 5 presents our main empirical analysis and findings. Section 6 concludes.

2 The French urban public transport industry

2.1 Organizational background

The general principles of the organization of urban public transport in France date back to the Transport Law of 1982[5]. It provides a guideline for the organization of public passenger transport in urban transport areas and establishes the concept of economic and social efficiency by declaring the right to affordable public transport. The public authority, consisting of cities or group of cities, is responsible for the organization of urban public transport in that it has to define, finance and organize it[6]. There exists no national regulator of the sector and transportation is regulated by local authorities. The choice to organize and provide the service itself, or

[5] Loi n° 82-1153 du 30 décembre 1982 d'orientation des transports intérieurs.

[6] As opposed to the rest of France, the region of Paris (Ile-de-France) has only one authority responsible for organizing urban public transport. It takes its decisions in consultation with dedicated transport carriers (RATP, SNCF and OPTILE).

to delegate the relevant responsibilities to a fully private or public-private operator is left to the public authority.

Currently, there are approximately 300 transport networks in France and nearly 90% of them are operated through delegated management (GART, 2015). In delegated management, the local authority chooses an operator to which it entrusts the operation of the service. The key feature of the French model is that the contract is attributed to only one operator who carries the responsibility of providing the relevant service in the whole urban transport area (see Yvrande-Billon (2006)). The relationship between the operator and the local authority is regulated through a contract in which the local authority specifies the characteristics of the service (number of stops, routes, frequency, output, schedule, quality of service, conditions for subsidizing the service, level of investment, ownership structure, obligations of operators to passengers, ticket prices, etc.), as well as the reimbursement scheme. In almost all networks, investment in the transport infrastructure remains the responsibility of the organizing authority.

2.2 Financial situation

Urban public transport in France is highly subsidized. Operators face public service obligations and are obliged to operate in low-density areas. Low prices are maintained in order to provide accessible transport to all consumers of urban transportation, as well as to attract new consumers. While the industry has seen a significant increase in the supply and quality of transport, this is not accompanied by a sufficiently strong demand for the service or by higher ticket fares. The strong social objective of the public policy of urban transport translates into pricing choices that are disconnected not only from total costs, but also from operating costs. As a result, the industry is currently facing strong financial constraints. The ratio of commercial receipts to operating costs has been deteriorating over the years. Commercial receipts currently cover, on average, hardly 30% of operating costs (Cour des Comptes (2015)). The remaining operating costs are covered by subsidies from the State, local authorities and a special transport tax paid by local firms[7].

[7] This transport tax consists of a local contribution of employers that allows to provide additional funding for urban public transport. It is imposed on employers of both the public and private sector that employ more than 9 full-time employees within an urban transport area of a population of more than 10,000. It is collected by each urban transport area.

2.3 Transport groups

Before the merger, nearly 70% of the operators were subsidiaries of three major groups, two of which private and one semi-public: Keolis, Veolia Transport and Transdev. In 2009 (prior to the merger), Keolis was 45% owned by the French National Railway Company SNCF. Veolia Transport was then a subsidiary of the French group Veolia Environment[8] and Transdev was owned in majority (69.6%) by the French public financial institution Caisse des Dépôt et Consignations (hereafter CDC). In addition, three smaller players were already present in the market at that time. RATP Développement (hereafter, RATP Dev), owned by RATP[9], was created in 2002. Our interviews with local operators suggest that RATP Dev has recently become an important player in the industry especially in small and middle-sized networks. In addition, two foreign groups were present in the market: Vectalia France and CarPostal. Vectalia France was a subsidiary of the Spanish group Subus and was present in France since 1998. The extent of the presence of Vectalia and CarPostal in France was mainly limited to transport areas close to the relevant boarders. The remaining operators were independent or belonged to local and regional transport groups.

Market shares measured by the number of networks of the respective groups are presented in figure (1). Prior to the merger, the leading transport group was Keolis (with a market share of nearly 30%), followed by Veolia Transport (26%) and Transdev (16%). In number of seat-kilometers provided, Keolis was the first operator with 38% market share. Transdev and Veolia Transport were respectively the second and third leading group with 23% and 20% market shares.

<Figure 1 about here>

2.4 Regulatory contracts and award mechanism

The dominant contract types observed in France are fixed-price and cost-plus contracts. In networks regulated under fixed-price contracts, operators receive subsidies according to their expected operating deficits. Therefore, profits of operators suffer from cost overruns and lower-than-expected revenues. In networks regulated under cost-plus contracts, the organizing author-

[8] Veolia Environnement is an international group with activities in water provision, water sanitation, waste treatment, cleaning and sanitation services, energy services and transport.

[9] RATP is the operator of urban transport in Paris. It is a public company.

ity collects commercial receipts and fully reimburses the operator's operating costs, increased by a pre-defined additional amount which constitutes the margin of the operator. Under this regulatory scheme, the regulator provides the operator with subsidies to cover its actual deficits. Cost changes hence do not affect the operator's profits.

In the past years, the industry has seen a move towards fixed-price contracts which are high-powered incentive schemes for operators. As a result, the proportion of networks that were regulated under a cost-plus contract has decreased substantially, from 100% in the 1970s, 60% in the 1980s, 25% in the 1990s (Yvrande-Billon (2006)) to only 7% in 2013 (GART (2015)).

Until 1993, the automatic renewal of contracts was a common practice (see Gagnepain and Ivaldi (2002)). The Sapin Law[10] made competitive bidding compulsory before awarding a contract for the provision of a public service. The aim of the law was to prevent collusion and corruption and enhance competition between the operators in the industry. It did not, however, forbid the use of negotiation in the procedure. As a result, operators are selected in a two-step procedure, i.e. a preselection step with the use of competitive bidding and a negotiation phase which allows for subjective selection criteria.

Mandatory competitive bidding for the choice of an operator did not immediately translate into a higher degree of competition between operators in the industry. Analyzing the years 1995-2002, Yvrande-Billon (2006) reports a large incumbent bias in tenders and a decrease in the average number of bidders per tender during the period. She explains this phenomenon by the lack of expertise of local authorities and the existence of serious collusive practices by the main operators in the industry, i.e. Keolis, Veolia Transport and Transdev in the years 1994-1999[11]. A more up-to-date analysis of the industry is, however, necessary to provide information about the competitive industry in the recent years.

[10] Loi n° 93-122 du 29 janvier 1993 relative à la prévention de la corruption et à la transparence de la vie économique et des procédures publiques.

[11] On July 5, 2005, following a referral by the Minister of Economy, Finance and Industry, the French Competition Authority sanctioned Keolis, Veolia Transport and Transdev for entering into a nationwide cartel between the years 1994 and 1999, dividing the market for public passenger urban transport by refraining from competition when a contract held by them came up for renewal. The French Competition Authority fined them 11.95 million euros.

3 The merger

3.1 The story

In 2002, the majority owner of Transdev (CDC) and RATP concluded a strategic partnership. RATP became a shareholder of Transdev with approximately 26 % of its shares. However, in 2009, both Transdev and RATP were not satisfied with this partnership. RATP was interested either to develop its activities in urban public transport outside of the Paris region through its subsidiary RATP Dev or take control of Transdev. CDC, on the other hand, wanted to remain the main shareholder of Transdev.

CDC, which is a public financial institution, started looking for a new partner for its subsidiary Transdev. Its goal, as declared publicly, was to avoid that 4 French transport groups compete for contracts outside of France. CDC indeed expected it to be detrimental to the success of the French transport industry and so it decided to create one large group which had the potential to win contracts abroad. The new entity was expected to be one of the biggest transport company in the world and to be taken public within two years after the merger. Veolia Transport and Keolis both expressed their interest in merging with Transdev in the Spring of 2009.

Near the end of July 2009, Trandev disclosed its choice of Veolia Transport. It has been argued at the time that Veolia Transport was backed by the French government and that the choice was mainly motivated by political considerations. Others claimed that the choice of Veolia Transport was simply the best for value creation because of the complementarity in the international presence and expertise of the two groups. Transdev was indeed operating mainly urban transports networks and Veolia Transport had a strong position in the interurban transport market. In addition, the two groups were present in different countries across Europe. Veolia Transport also had a strong position outside of Europe. Another potential reason that drove Transdev's choice of Veolia Transport was the fact that the CDC was the main shareholder of the Veolia Environnement group (the owner of Veolia Transport)[12].

The operation was first notified to the European Commission. On August 12, 2010, the European Commission referred to the French Competition Authority for an examination of the

[12] At the time, CDC owned 10% of the capital share of Veolia Environnement and had one seat in the Executive Board.

French part of the concentration. The merger was authorized with remedies by the French Competition Authority in December 2010[13] and the final closing of the operation occurred on March 3, 2011.

3.2 Competition concerns of the French Competition Authority

As certain competition concerns arose during the analysis of the merger by the French Competition Authority, it was approved subject to several commitments taken by the merging parties. In particular, the French Competition Authority considered that the merger raised competition concerns in the urban transport market which we analyze.

The Competition Authority was concerned that the decrease in the number of candidates resulting from the merger could increase the prices of bids submitted in tenders and decrease the quality and diversity of offers. To identify the concerned networks and assess the intensity of competition, it performed a detailed study of past tenders and market shares. It argued that potential anticompetitive effects were a relevant threat in networks where both groups would submit an offer (20-25% of tenders in 2009)[14]. These potential anticompetitive effects were particularly strong in the South of France in the Provence Alpes Côte d'Azur (hereafter PACA) region, where the presence of Veolia Transport and Transdev was most pronounced.

In order to address these concerns, the parties proposed to finance the creation of a competition stimulation fund in the amount of 6.54 million €. This remedy was introduced to compensate the expenses associated to responding to tenders for small candidates, in the case they were not selected, as well as to help local authorities organize the selection process. The purpose of the fund was to encourage small competitors to take part in tenders. The fund also aimed at helping small organizing authorities to improve their efficiency in the competitive bidding procedures. This fund was reserved for transport networks in which Veolia Transport and Transdev were the outgoing operators and that would be subject to open competition within five years of the merger realization date (forty-four tenders in total). In addition, to resolve the problems specific to the PACA region, the parties were obliged to sell their shares and assets in the operation of four urban transport networks located in the PACA region.

[13] Autorité de la concurrence, Décision n°10-DCC-198 du 30 décembre 2010 relative à la création d'une entreprise commune par Veolia Environnement et la CDC.

[14] Autorité de la concurrence, Décision n°13-DCC-137 du 1er octobre 2013 relative à la prise de contrôle exclusif de la société Transdev Group (ex-Veolia Transdev) par la Caisse des Dépôts et Consignations.

The relevant organizing authorities refused to authorize the divestiture of the contracts in all four networks concerned by the remedy. Hence, no divestitures occurred. The new entity was not, however, authorized to compete in the tenders for the renewal of these contracts[15]. To our knowledge, two of them were renewed in October 2013 and the new entity did not make an offer in these tenders. Concerning the competition stimulation fund, information on its use is not available publicly and hence we could not shed any light on its use.

Concerning efficiency gains, the Competition Authority explained in the decision that the merging parties argued that the merger would create substantial efficiency gains, in particular a reduction in operating costs due to pooling purchases. The Authority however considered that the occurrence of such efficiency gains was not credible enough to counterbalance potential anticompetitive effects from the merger.

3.3 Potential efficiency gains

As in the case of most mergers, the merger between Veolia Transport and Transdev is associated with potential both anticompetitive and pro competitive effects. On the one hand, the merger resulted in a decrease in the number of players in the industry and potentially the number of bidders in the relevant tenders. This could lead to anticompetitive effects. On the other hand, the merger may have resulted in efficiency gains in the form of cost efficiencies. If these cost efficiencies were passed on to local authorities in the form of more attractive bids in tenders, the merger may have possibly benefited consumers. We briefly present the potential sources of cost efficiencies in the case of the merger we analyze.

Potential efficiency gains may come from knowledge sharing between local operators. Local operators are indeed likely to share knowledge at the group level on how to efficiently operate a network. Gagnepain and Aguiar (2013) use an earlier version of our database (up to 2001) to show that an operator belonging to an industrial group benefits from the cost reducing activities of the remaining operators of the group because knowledge generated by a local operator is processed by the headquarters of the group and transmitted to other networks operated by the group. They suggest that cost reducing activities may concern for instance process R&D, the search of cheaper suppliers, experience in procurement contracts bargaining or methods in

[15] Autorité de la concurrence, Décision n°13-DCC-137 du 1er octobre 2013 relative à la prise de contrôle exclusif de la société Transdev Group (ex-Veolia Transdev) par la Caisse des Dépôts et Consignations, par.43.

monitoring employees. A merger between two groups might hence allow methods, procedures and general knowledge of operators of one group to be passed on to operators belonging to the other.

Further, potential efficiency improvements may come from improved managerial efficiency. A change in the managerial policies and procedures imposed to local operators by the new group may have moved networks of the new entity closer to the best practice of the industry. The merger may have changed the attitude of the management, motivating it and making it more efficient. Cost efficiencies may also be a result of a more stable management at the regional and national level. To our knowledge, management was very unstable in Veolia Transport prior to the merger. Regional and national managers changed very frequently. Since they are responsible for monitoring operating costs of local operators, a more stable managing team could help local operators to be more efficient.

Finally, the spread of the specific values and specificities of each group to the other group may reduce operating costs.

However, local transport operators may be to some extent autonomous from their group. Also, the cultures of the merging entities (Veolia Transport and Transdev) were quite different prior to the merger, making their transaction potentially problematic. The resulting empirical question concerns whether the merging entities encountered merger efficiency gains.

4 Competition assessment

Before we move on to the main topic of interest, we perform a descriptive analysis of the level of competition in the industry. This assessment aims at providing some insight concerning the incentives transport operators may have to increase or decrease subsidies in the offers they submit to local authorities in tenders. Facing no competition in tenders, operators have no incentive to submit low bids. On the other hand, increased competition in tenders may provide operators with incentives for cost-reducing effort enabling them to submit lower bids. An additional reason for performing this analysis is that, as mentioned before, the evolution of the competitive intensity in the industry has not been studied for almost 10 years. Based on an analysis of the pre-2005 data, the market had been described as characterized by a large incumbency bias and little competition.

We use an original database gathering tenders for the choice of a transport operator which took place in the years 2004-2013. This information was obtained from press releases, as well as from representatives of organizing authorities. Data includes the identity of the transport operators that submitted bids in the tender, the identity of the incumbent transport operator, as well as the identity of the winner of the compeitive bidding procedure.

Figure 2 reports the evolution of the replacement rate, which corresponds to the percentage of competitive tenders in which the incumbent operator was replaced by one of its competitor. In 2000-2005, approximately 80-90% of networks where a tender was launched did not see a change of operator. The replacement of the incumbent by another operator occurred more frequently in 2006 (32%), 2008 (41%) and 2009 (42%). Since 2010, it maintains at a moderate level of approximately 25%. The replacement rate observed post merger is not substantially different to the one observed in 2010. It is, however, nearly half as high as the rate observed in 2008 or 2009, when competition appeared to be particularly intense.

<Figure 2 about here>

Not surprisingly, in the period 2000-2013, the incumbent took part in almost all tenders for the renewing of its markets (between 94% and 100%, depending on the year considered). To get a better sense of the intensity of competition, we study the share of tenders with offensive bids (offers of operators other than the incumbent operator) in the total number of tenders. Figure 3 presents the share of tenders with offensive offers submitted by operators belonging to the main transport groups (Keolis, Veolia Transport, Transdev, RATP or Carpostal). In 2004 and 2005, they submitted offensive offers in slightly more than 30% of the tenders. In 2006 and 2007, this rate increased to approximately 45% and exceeded 60% in 2009. The share of tenders with offensive offers by operators belonging to these groups remained high after 2009. The rate reached a particularly high level in 2011 (71%[16]) and a particularly low level in 2012 (43%), while in 2013 it almost returned to the level it had reached in 2009.

<Figure 3 about here>

Figure 4 presents the percentage of offensive bids in the total number of bids submitted separately for each transport group. The three main groups (Keolis, Veolia Transport and

[16]This percentage is identical for contracts signed before and after the merger in 2011.

Transdev) became increasingly aggressive starting from 2005[17]. Veolia Transport reached a particularly high level of participation in offensive bids in 2008 and 2009 (more than 30%). This rate decreased to approximately 20% in the following years. Transdev also decreased its participation in offensive bids after 2009. Keolis maintained its participation at an average level of 23 % in the years 2010-2013. We find that the low share of tenders with offensive bids which we observe in 2012 is mainly due to the merged entity, which submitted offensive bids in less than 1% of the tenders in 2012. This rate, however, exceeds 20% in 2011 and 2013.

Interestingly, RATP Dev acted increasingly offensive from 2008 onwards. This finding is consistent with public declarations of RATP Dev which expressed its willingness to challenge the main groups. Our interviews with practitioners also confirm this finding.

<Figure 4 about here>

The previous findings are also reflected in the average number of bids per tender (see figure 5). The share of tenders which did not attract any bid other than the incumbent's decreased from 70% to 13% between 2004 and 2011. This dramatic drop clearly reflects a change in the competitive pressure in the market. In 2012, in approximately half of the tenders there was no competition between operators. In 2013, this proportion was 29 % (which is similar to the level observed in 2009). Hence competition increased a lot between 2004 and 2011. Afterwards, it was particularly low in 2012. The average number of bids observed for 2013 does not differ, however, from the years observed before the merger.

Furthermore, The share of tenders with two bidders increased slowly during the period of our analysis from 15% to more than 50%. It did not change, however, following the merger. The proportion of tenders with more than two bidders increased from 8% in 2004 to 22% in 2007. It

[17] This may presumably be the effect of the Frenchh Competition Authority's decision to punish Kéolis, Connex (afterwards Veolia Transport) and Transdev for entering into a nationwide anti-competitive agreement. On July 5, 2005, following a referral by the Minister of Economy, Finance and Industry, the French Competition Authority decided to punish with a fine Kéolis, Connex (afterwards Veolia Transport) and Transdev for entering into a nationwide anti-competitive agreement between the years 1996 and 1998. The public passenger sector in the period concerned was defined as an oligopolistic market dominated by three groups, the directors of which formed a cartel in the intention of dividing the market for public passenger urban transport by refraining from competition when a contract held by them came up for renewal. In the case where they had an objective advantage of their own interests, they were able to exchange markets. This resulted in the companies imposing their prices on local and regional authorities, and consequently the administrations concerned had to face higher costs as compared to a case of open competition. Justified by the the serious anticompetitive practises carried out by the parties concerned, the French Competition Authority decided to the highest, in force at the time of the facts, fines, i.e.: Kéolis was fined 3.90 million euros, Connex - 5.05 million euros, and Transdev - 3.00 million euros.

then remained at a stable level of approximately 20% until 2010. It reached a particularly high level in 2011 and a low one in 2012, while the year 2013 is similar to 2010.

<Figure 5 about here>

The average number of bids per tender shows a clear increasing trend in the period 2004-2011 (see figure 6). It is, however, difficult to detect any clear pattern for the period after 2010: a very high level is observed in 2011, 2012 is particularly low, while 2013 is similar to 2010.

<Figure 6 about here>

The analysis of our data on tenders shows that competitive intensity in the industry increased substantially from 2004 to 2011 (measured by the replacement rate, the rate of offensive bids and the average number of bidders per tender). We do not observe a clear step back in the competitive intensity following the merger. More years of data observed post merger would be however useful to conclude on whether the drop in competition intensity observed in 2012 may occur once again or whether the return to levels observed prior to the merger is durable.

Although more years of data would be required to draw any definitive conclusion, we do not find that the merger resulted in less candidates in tenders and hence reduced competition intensity. A possible explanation may be that the competition stimulation fund accepted as a remedy to the concentration prevented the drop in the number of candidates in tenders. This hypotheses is hard to verify since we do not have any information on its use.

5 Merger evaluation

5.1 Empirical strategy

Our goal is to perform an ex post evaluation of the merger that took place between Veolia Transport and Transdev, by taking a closer look at operating costs of urban transport operators. We are interested in studying whether the merger resulted in cost efficiencies achieved by the new entity.

Ideally, we would like to compare actual post-merger market outcomes of networks affected by the merger with market outcomes in these same networks in a world where the merger did not take place. This, for obvious reasons, is impossible. The econometric strategy seeks thus

to construct a counterfactual group that reflects as closely as possible how market outcomes of networks affected by the merger would have evolved if the merger had not occurred. The evolution of market outcomes of operators belonging to Veolia Transport or Transdev which were affected by the merger (treatment group) are then compared to the evolution of market outcomes of networks which were not affected by the merger (control group).

Our empirical investigation starts with a simple before-after estimation of the effect of the merger on operating costs of networks operated by Veolia Transport and Transdev. In the before-after estimation, the central assumption is that, conditional on covariates, operating costs of networks operated by Veolia Transport and Transdev would have remained the same absent the merger. This assumption is strong, as unobserved factors may have affected the evolution of operating costs.

The following regression is estimated:

$$ln(C_{nt}) = \alpha_0 + \alpha_1 Post_t + \sum_i \gamma_i X_{int} + \delta_n + Ttrend_t + e_{nt}, \quad (1)$$

where C_{nt} represents operating costs, $Post_t$ is a dummy variable taking the value 1 post- merger, X_{nt} is a vector of factors other than the merger affecting operating costs, $trend_t$ is a yearly time trend, δ_n is a network specific fixed-effect and e_{nt} is the error term. The subscript n indexes urban transport networks and t indexes years. α_0, α_1, γ_i and T are the coefficients to be estimated. Our focus is put on the sign of α_1 , which allows us to assess the existence (and possibly extent) of efficiency gains coming from the merger. The regression includes a time trend, as operating costs seem to follow a steady increase over the years. Regressions both with and without networks fixed-effects are considered[18].

We also impose a constraint of homogeneity of degree one in input prices:

$$\gamma_L + \gamma_M + \gamma_O = 1, \quad (2)$$

where γ_L, γ_M and γ_O represent coefficients on respectively labor price, material price and overhead price.

Our data then allows us to employ a difference-in-differences (hereafter, DiD) approach to estimate the impact of the merger on operating costs of local urban transport operators. The key

[18]The use of fixed-effects implies that the effect of the merger is solely identified for networks for which we have data both before and after the merger.

assumption behind the use of this method is that outcomes (operating costs) in the treatment group and control group would have followed, conditional on covariates, parallel trends over time absent the treatment (merger). The ideal control group is such that the variable of interest evolves similarly as in the treatment group with the only difference that it did not experience the treatment.

Another key assumption of the method is that the merger is exogenous. This assumption may be violated if omitted variables affect both the market outcome studied and the decision to merge. This endogeneity problem results in a biased effect of the merger. This is the case, for example, when unobserved shocks impact both costs and the decision to merge. The model may also suffer from reverse causality between the market outcome and the merger. For example an increase in operating costs may trigger a merger in order to create costs savings. On the other hand, a merger may impact costs incurred by operators. This assumption needs to be verified.

We estimate the following equation:

$$ln(C_{nt}) = \alpha_0 + \alpha_1 Post_t + \alpha_2 Treat_n + \alpha_3 Post_t * Treat_n + \sum_i \gamma_i X_{int} + \delta_n + e_{nt} \qquad (3)$$

where α_2 measures, *ceteris paribus*, the difference in operating costs between the treatment and control groups and α_3 provides a measure of the effect of the merger on the operating costs of the merged entities.

We impose the constraint of homogeneity of degree one in input prices, as presented in equation 2 and estimate the effect of the merger with and without fixed-effects. In addition, we allow for heterogeneous merger effects depending on the contract type in place (fixed-price or cost-plus contract).

Our control groups are defined in the following way. In all groups, we consider only networks that are operated by Keolis, RATP Dev and Carpostal[19]. We gathered evidence from operators in the industry that these groups are similar with respect to their operating costs and respond to cost shocks in the same way. Our first control group (C_1) is composed of all networks managed by these groups. In the other groups, we account for potential spill-over effects from the merger to networks operated by competitors of the merging parties. We believe that the strategic behavior of firms, if any, could appear in competitive bidding procedures so that it would only concern

[19]We have also considered all groups of transport separately. This does not change our results. For sake of clarity, we do not present the results of the additional control groups considered.

contracts signed after the merger. In order to account for the possible reaction of competitors post-merger, we considered three alternative control groups. Our second control group (C_2) is composed of only networks of the three groups for which the contract for the operation of the urban transport service in a given network was signed prior to the merger. Further, we exploit our database on tenders. The third control group (C_3) consists only of networks where competition seems to be absent, which is considered to happen in networks that did not see a change in operator since 2005 and in which only one offer was submitted in tenders which took place since 2004. Finally, we considered only networks in which Veolia Transport and Transdev did not submit a bid in the tenders for the operation of the transport service in the period of our analysis (referred to as control group C_4). We expect that the rivals of Veolia and Transdev will not react to the merger in networks in which there is no change in operator in the period or in which Veolia Transport and Transdev do not take part in tenders.

Our analysis covers the period 2005[20]-2013. In addition, we perform estimations excluding the years 2009 and 2010. This corresponds to the period between the announcement of Transdev wanting to merge and the merger itself. As this announcement may have impacted the operating costs of Veolia Transport, Transdev or its rival groups, we perform additional estimations excluding this period.

5.2 Data and variables

Our study uses a 9-year panel of 131 urban public transport networks in France for the years 2005-2013, with a total of 893 observations. The database has been created from an annual survey conducted by the Centre d'Études et d'Expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement (CEREMA) in collaboration with the Groupement des Autorités Responsables de Transport (GART) and the Union des Transports Publics et ferroviaires (UTP). The database contains details on the actors taking part in providing the service, the regulatory environment, as well as costs and revenues of operators. For sake of homogeneity across observations, only bus networks serving more than 20,000 inhabitants in the territory of France have been selected for the analysis.

Studying the effects of the merger on operating costs requires data on the operating costs

[20]We test several alternative time windows, starting at 2006 and 2007. This does not change our results significantly and conclusions of our analysis remain the same.

themselves, as well as factors, other than the merger, influencing them. Operating costs C are defined as the sum of labor costs, material costs and overhead costs (which include cost of external services, taxes and other costs). Output Y is measured by the number of seat-kilometers, i.e. the number of seats available in all buses multiplied by the number of kilometers traveled on all routes. We thus use a supply-oriented output variable. Labor price w_l is obtained by dividing labor costs by the annual number of employees employed directly by the operator[21]. Material price w_m is obtained by dividing material costs by the total number of vehicles operated by the operator (without including subcontracting vehicles). Overhead price w_o is constructed by dividing overhead costs by the number of trips per year. The local authority owns the rolling stock and infrastructure, which are put at the disposal of the operator. Since the operator does not own the capital, it does not incur capital costs. The total length of the network N is measured in kilometers. In addition, we account for the regulatory contract type put in place. We construct a dummy variable CP that takes the value 1 when the contract is cost-plus, instead of fixed-price.

Descriptive statistics of our database are presented in Table 1. In our sample, average operating costs exceed 9,000€. Labor costs constitute the most important part of operating expenditures (54%), which is consistent with what is observed in the industry. The average input prices are approximately 38€ per employee, 19€ per car and 0.71€ per trip. The average size of network is approximately 258 km and more than 2.5 million seat-kilometers are supplied, on average, yearly. As mentioned, in the recent years there was a move towards high-powered incentive contracts. This could indeed be observed in our database, as over 90% of the contract types in our sample are fixed-price.

<Table 1 about here>

Constructing our treatment and control groups requires information on the identity of the group to which transport operators belong to. In addition, the construction of two of our four control groups ($C3$ and $C4$) involves further exploiting the database on tenders, presented in the previous section. The frequencies of our treatment and each of our control groups pre- and post-merger are presented in Table 2.

[21] Labor costs concern employees employed directly by the operator. Consequently, the number of employees does not include the employees of companies to which the operator outsources some activities.

<Table 2 about here>

5.3 Identification

The key identifying assumption of the DiD estimation method is that had the treatment not been implemented, operating costs of the treatment group and control group would have followed, conditional on the control variables included in the regression, the same evolution. In other words, operating costs of the networks in our control group are not affected by the merger, but economic factors other than the merger have a similar impact on both the control and treatment groups. This assumption can be verified by comparing the evolution of costs, conditional on other covariates included in the regression (X_{int}), of the treatment and control groups (see figures 7 - 10).

<Figures 7 - 10 about here>

These graphs suggest that the parallel trends assumption is satisfied.

The other important assumption is that the choice to merge is not endogenous. Here, the decision to merge was not linked in any way to operating costs of networks operated in France or factors influencing them. Transdev belongs to a public financial institution. Its initiative to merge with another French transport company must be understood within this context. As already mentioned, Transdev decided to merge because neither Transdev nor RATP were satisfied by the partnership they had concluded in 2002 so RATP wanted to divest its share of Transdev and develop its subsidiary RATP Dev. The owner of Transdev expected that competition between 4 French transport groups for contracts abroad was likely to be detrimental to the success of those groups and therefore to the French transport industry. They also expected that the creation of a very large group would help win contracts abroad. The initiative of Transdev was hence strategic for the development of the French transport industry through the winning of contracts for the operation of networks abroad. Additionally, Veolia Transport was chosen to merge with Transdev because of either political considerations, complementaries between the two groups or the participation of the owner of Transdev in the ownership of the Veolia Environnement (owner of Veolia Transport). We are thus strongly convinced that the treatment is not endogenous to operating costs of networks operated in France.

5.4 Impact on costs

Our preliminary analysis consists in the comparison of costs before and after the merger for the merging parties. The results of estimating our before-after estimation presented in (1) are given in Table 3.

<Table 3 about here>

Models M1-M4 are simple ordinary-least square regressions, whereas models $M5$ - $M8$ include fixed-effects to account for the time-invariant heterogeneity between networks. The before-after estimations with fixed-effects $M6$ - $M7$ suggest that operating costs of Veolia Transport and Transdev increased post-merger. However, when accounting for the positive trend observed in the evolution of operating costs, this effect is no longer significant ($M8$). Furthermore, when excluding the years 2009 and 2010, results do not change significantly (see Table 4).

<Table 4 about here>

Our before-after estimation suggests thus that operating costs of the merging parties did not change significantly as a result of the merger. Their operating costs, controlling for observed characteristics other than the merger impacting operating costs, have faced a steady upward trend since 2005.

The before-after analysis does not control, however, for changes in economic factors that may impact operating costs, but are unobservable to the econometrician. In order to account for these factors we perform a DiD estimation, where the costs of the merging parties are compared respectively to our four control groups ($C1$-$C4$).

The results of estimating equation (3) are presented in Table 5 and Table 6, the latter excluding the years 2009-2010. In addition, we have included the results of estimating (3) without the constraint of homogeneity of degree one in input prices, which is presented in Table 7. In order to address serial autocorrelation issues, standard errors are clustered by network (see Bertrand, Duflo and Mullainathan (2004)) in all regressions.

<Tables 5, 6 and 7 about here>

The point estimates of the coefficients in the regressions which do not include fixed-effects (columns 1 to 4) could be considered high (between 7% and 14%, depending on the specification).

In the regressions with fixed-effects (columns 5 to 8) they are much lower (between 2% and 4%). The point estimates suggest that operating costs of the merging parties increased because of the merger but the estimates are not statistically significant at the 5% level. We thus conclude that the merger did not lead to cost efficiencies. In all regression considere, coefficients on the remaining covariates are of the expected signs and magnitudes.

The fact that we do not observe any significant average result might suggest that our framework fails to take into account some important underlying heterogeneity in the behavior of networks exploited by Veolia Transport and Transdev. Gagnepain and Ivaldi (2002) suggests that operating costs may differ depending on the type of regulatory contract type in place (fixed-price or cost-plus). In particular, fixed-price contracts generate more incentives for cost-reductions than cost-plus contracts. We hence examine whether the effect of the merger differs between fixed-price and cost-plus contracts. Table 8 reports the estimated coefficients for heterogeneous treatment effects. The terms $Post$, $Treat$ and $Treat * Post$ are interacted with the dummy variable associated to the choice of a cost-plus contract CP. It is worth stressing that cost-plus contracts account for only approximately 10% of all our observations[22].

<Table 8 about here>

Our results suggest that, for certain specifications considered, the increase in operating costs post merger for the merging entities is more pronounced for networks regulated under cost-plus contracts than for networks regulated under fixed-price contracts. The difference is, however, small in value and insignificant in all specifications considered. We conclude that the effect of the merger on the merging groups did not differ significantly, depending on the contract type in place.

Our results show that Veolia Transport and Transdev did not benefit from efficiency gains on operating costs. Local operators explain this finding by the fact that margins in the sector are extremely low and operating costs cannot be further reduced. Another more compelling reason for the absence of efficiency gains is that the merger proved in practice extremely difficult to implement successfully because of the differences in the two companies' cultures, the fact that the merger was not carefully prepared operationally and that numerous disagreements between the

[22] Also, in control groups $C2$, $C3$ and $C4$ only one network is regulated under a cost-plus contract.

managements of the two groups emerged. This view is expressed in the qualitative assessment of the merger performed by the French Court of Auditors (see Cour des Comptes (2016)). In particular, when the merger was closed in March 2011, the staff representative bodies had no information on the merger, no decision had been taken regarding the new brand and logo, on the localization of the headquarters of the new group or on the reorganization of the networks in France and abroad. Additionally, the management of Transdev was not in favor of the merger. Prior to the merger (2009), it expressed that it did not support the decision to merge with Veolia Transport. The new CEO of the group was also not welcomed by Transdev[23].

The consequence is that, after the merger, the merged entity focused on the problems which occurred at the group level and left local subsidiaries manage themselves on their own. Expertise sharing and the spreading of cost-savings technologies at the group level, as well as the implementation of a new culture at the local level probably did not happen. Managers were not motivated by the merger, be it at the local, regional or group level so the consolidation did not improve managerial efficiency. Focarelli and Panetta (2003) suggest that cost efficiency gains take time to occur. We do not exclude this possibility here since the merger was not well prepared at all.

6 Conclusion

The goal of our analysis was to evaluate retrospectively efficiency gains from the merger that took place between Veolia Transport and Transdev in the French urban public transport industry in 2011. Our analysis is based on an original database which provides information on the characteristics of urban transport networks and the details on operating costs incurred by local urban transport operators for the years 2005-2013, that is before and after the merger. This database was complemented by a database of competitive tenders which occurred in the period 2004-2013, which allows us to identify networks which were most likely not affected by the merger. In addition, we are able to provide an up-to-date analysis of the competitive intensity in the sector, which has not been done to our knowledge since 2005.

We employ a difference-in-differences methodology to study potential merger efficiency gains.

[23]The CEO was originally supposed to be the CEO of Transdev but, just before the merger, another CEO was imposed by Veolia Environnement.

We test several control groups and time windows. We also account for heterogeneous treatment effects, by studying the effect of the merger, depending on the regulatory contract in place. Our results show that the merger did not lead to any efficiency gains for the merging parties. A possible explanation is that the merger was not successful because of the differences in cultures of the two groups, the lack of preparation of the merger by the two companies, as well as the numerous disagreements between the managements of the two groups. Expertise sharing and the spreading of cost-savings technologies at the group level, as well as the implementation of a new culture at the local level most probably did not take place. Managers were also not motivated by the merger, be it at the local, regional or group level. Consequently, the merger did not improve managerial efficiency.

We believe that although the possibility to use our study alone to comment on the French merger policy in general is limited, the results, combined with other similar ex post studies of efficiency gains from merger, could help competition authorities get a clear idea of efficiency gains to be expected from mergers. Since they are often a central aspect of the economic motivation behind a merger, there is a clear need for more of such studies.

Figure 1: Market shares (in number of networks)

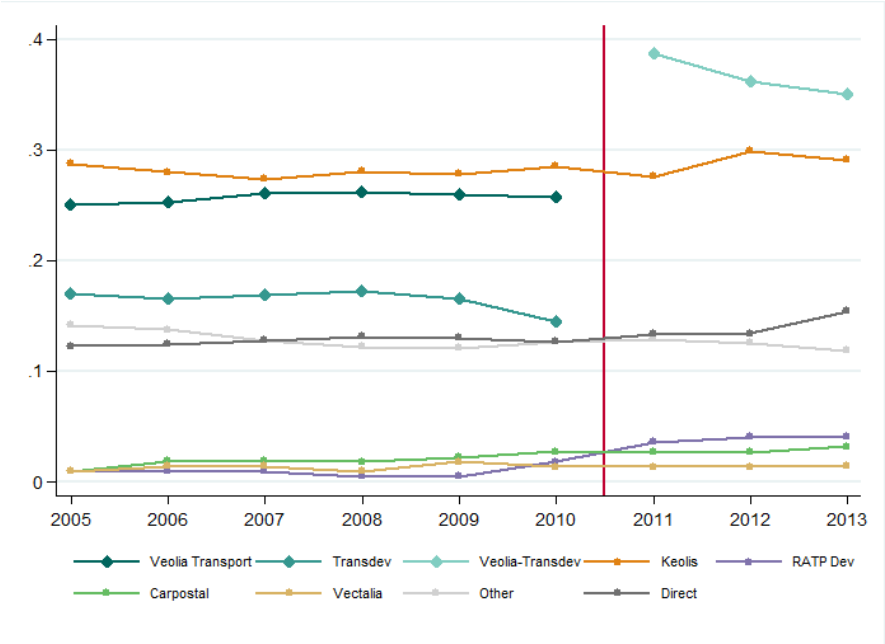

Figure 2: Replacement rate in tenders (in %)

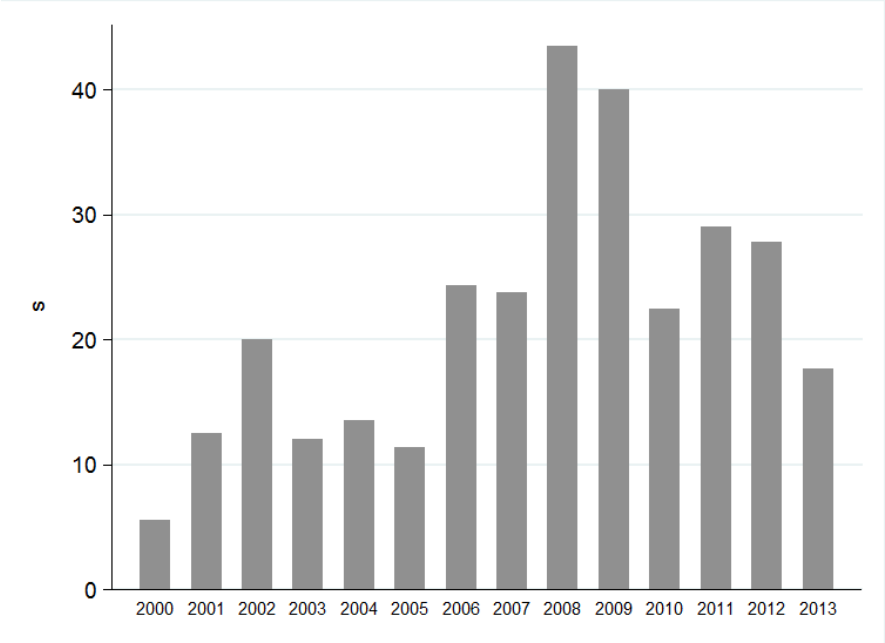

Figure 3: Percentage of tenders with offensive offers made by the main transport groups

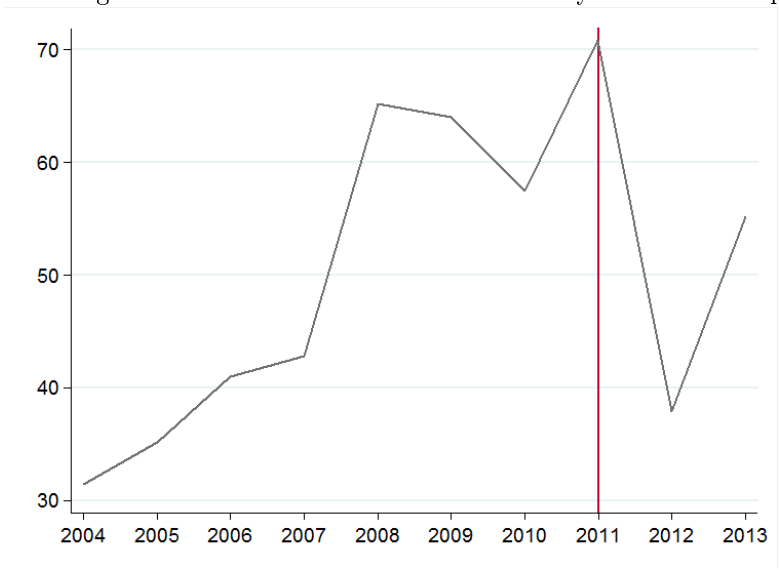

Figure 4: Rate of offensive bids per transport group

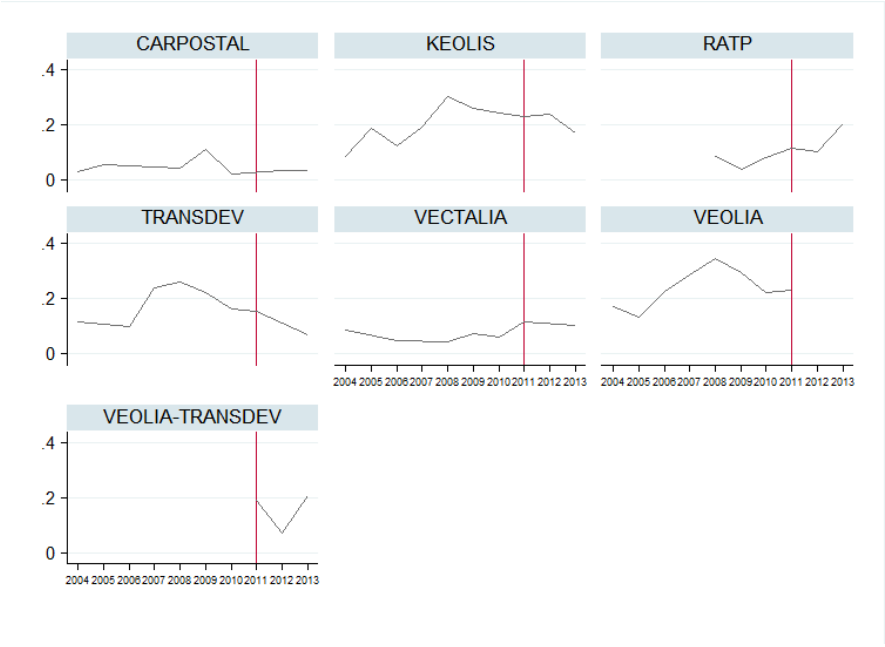

Figure 5: Number of bids per tender (in %)

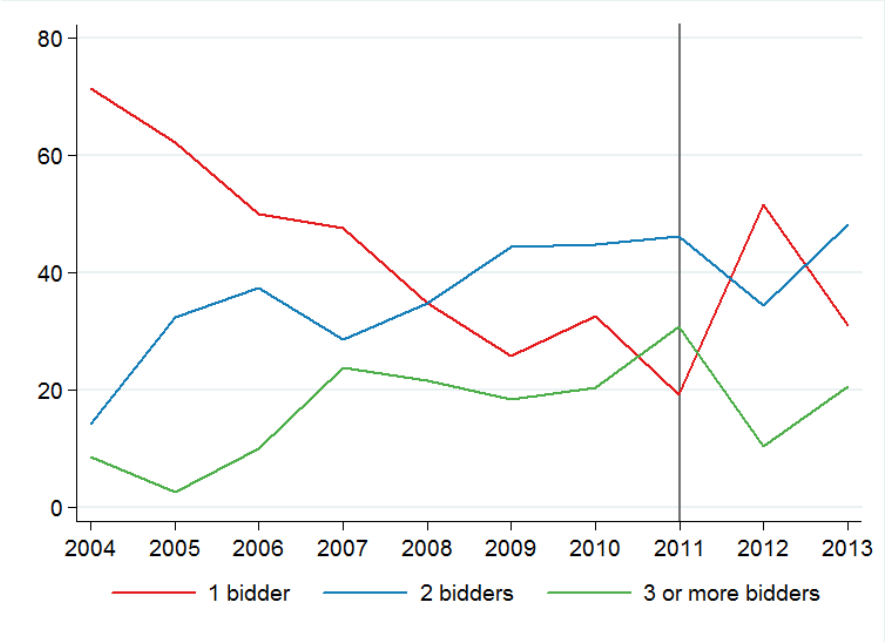

Figure 6: Average number of bids per tender

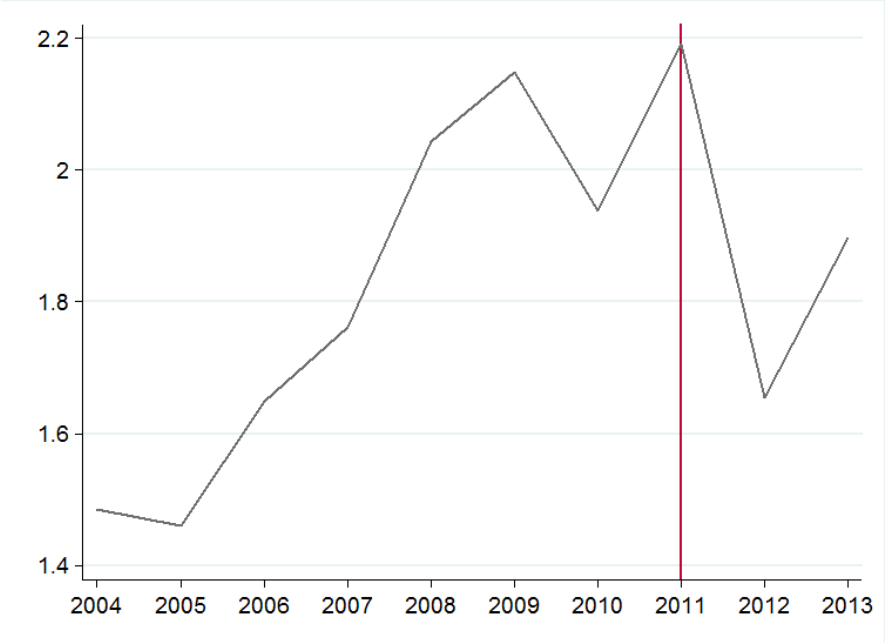

Figure 7: Residuals of the DiD estimation with fixed-effects (C1)

Figure 8: Residuals of the DiD estimation with fixed-effects (C2)

Figure 9: Residuals of the DiD estimation with fixed-effects (C3)

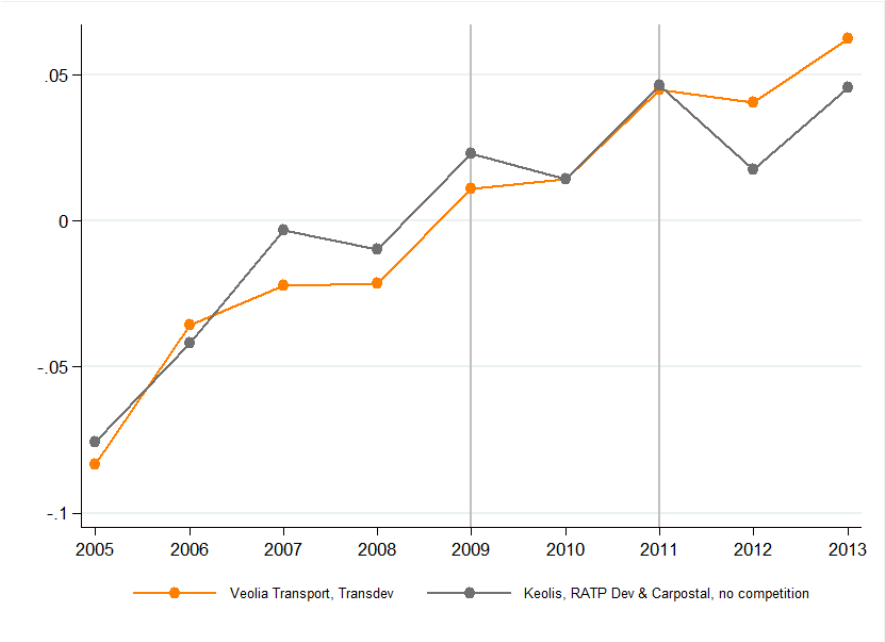

Figure 10: Residuals of the DiD estimation with fixed-effects (C4)

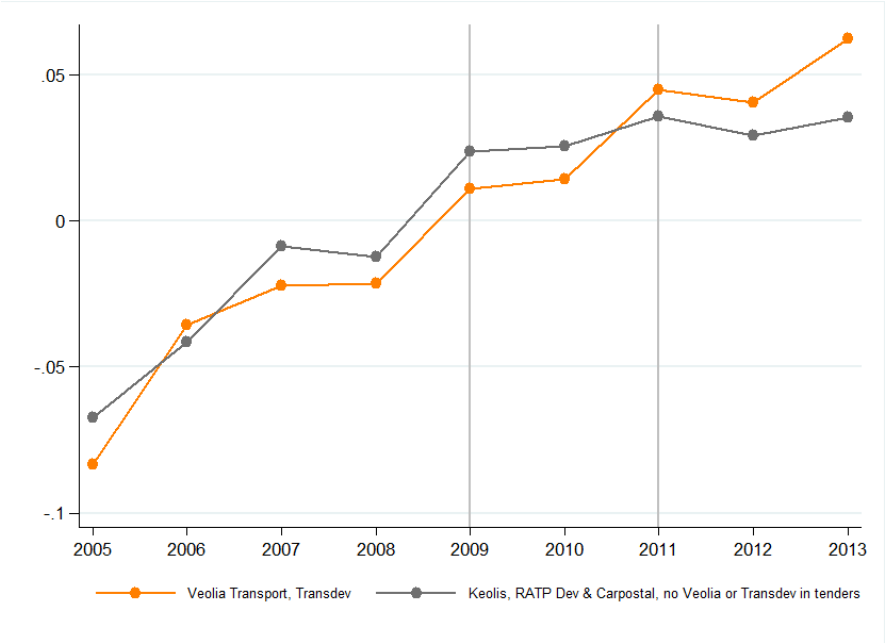

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
C	9381.38	11213.22	378.89	78589.57	883
Y	2517420.64	2668437.82	104246	14096253	883
N	257.71	346.42	13	7274	883
CP	0.09	0.29	0	1	883
w_l	37.09	5.22	22.33	52.97	883
w_m	18.95	6.79	1.69	59.72	883
w_o	0.71	0.58	0.08	5.75	883
labor part	0.54	0.11	0.13	0.79	883
materials part	0.13	0.04	0.02	0.46	883

Table 2: Treatment and control groups

Groups	Pre-merger	Post-merger	Total
Treatment group	253	121	374
Control group $C1$	248	141	389
Control group $C2$	248	111	359
Control group $C3$	62	25	87
Control group $C4$	90	37	127

Table 3: Before-After estimation

	M1	M2	M3	M4	M5	M6	M7	M8
$Post$	0.047	0.041	0.059*	-0.049	0.025	0.095***	0.099***	0.0087
	[0.053]	[0.034]	[0.033]	[0.057]	[0.030]	[0.019]	[0.018]	[0.014]
$ln(Y)$	0.74***	0.95***	0.87***	0.87***	0.20**	0.25***	0.24***	0.25***
	[0.028]	[0.018]	[0.024]	[0.024]	[0.099]	[0.068]	[0.065]	[0.059]
$ln(w_l)$		0.36***	0.36***	0.36***		0.57***	0.59***	0.58***
		[0.070]	[0.065]	[0.064]		[0.056]	[0.055]	[0.056]
$ln(w_o)$		0.40***	0.36***	0.36***		0.32***	0.31***	0.31***
		[0.031]	[0.029]	[0.029]		[0.043]	[0.043]	[0.040]
$ln(N)$			0.13***	0.13***			0.054***	0.046**
			[0.026]	[0.026]			[0.019]	[0.021]
$Trend$				0.024**				0.021***
				[0.010]				[0.0040]
$Constant$	-2.90***	-4.25***	-4.14***	-53.2***	3.43***	3.48***	3.17***	-39.4***
	[0.34]	[0.27]	[0.26]	[20.1]	[1.14]	[0.79]	[0.76]	[8.29]
Network fixed-effects	No	No	No	No	Yes	Yes	Yes	Yes
N	374	374	374	374	374	374	374	374
R2-adjusted	0.75	0.90	0.91	0.91	0.024	0.83	0.83	0.86

Standard errors in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The monetary variables C, w_l and w_o have been normalized with respect to the factor price w_m to ensure that the costs function is homogeneous of degree one in input prices.

Table 4: Before-After estimation excluding the years 2009-2010

	M1	M2	M3	M4	M5	M6	M7	M8
$Post$	0.10*	0.067*	0.085**	-0.046	0.094**	0.12***	0.13***	0.019
	[0.055]	[0.035]	[0.035]	[0.098]	[0.037]	[0.022]	[0.021]	[0.024]
$ln(Y)$	0.75***	0.95***	0.88***	0.88***	0.16**	0.23***	0.22***	0.24***
	[0.032]	[0.020]	[0.027]	[0.027]	[0.079]	[0.068]	[0.066]	[0.066]
$ln(w_l)$		0.36***	0.37***	0.37***		0.58***	0.61***	0.62***
		[0.078]	[0.073]	[0.073]		[0.069]	[0.070]	[0.066]
$ln(w_o)$		0.38***	0.34***	0.34***		0.29***	0.28***	0.29***
		[0.033]	[0.033]	[0.033]		[0.048]	[0.049]	[0.051]
$ln(N)$			0.12***	0.11***			0.054**	0.048*
			[0.029]	[0.029]			[0.025]	[0.025]
$Trend$				0.024				0.020***
				[0.017]				[0.0055]
$Constant$	-3.00***	-4.30***	-4.20***	-52.9	3.75***	3.57***	3.28***	-37.7***
	[0.37]	[0.30]	[0.28]	[33.7]	[0.92]	[0.78]	[0.77]	[11.2]
Network fixed-effects	No	No	No	No	Yes	Yes	Yes	Yes
N	293	293	293	293	293	293	293	293
R2-adjusted	0.76	0.90	0.91	0.91	0.079	0.81	0.82	0.83

Standard errors in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The monetary variables C, w_l and w_o have been normalized with respect to the factor price w_m to ensure that the costs function is homogeneous of degree one in input prices.

Table 5: Difference-in-differences estimation

	C1	C2	C3	C4	C1	C2	C3	C4
$Post \times Treat$	0.073	0.082*	0.098	0.11*	0.019	0.019	0.019	0.017
	[0.046]	[0.048]	[0.071]	[0.061]	[0.024]	[0.023]	[0.035]	[0.031]
$Post$	-0.0096	-0.018	-0.041	-0.046	0.073***	0.074***	0.079***	0.081***
	[0.027]	[0.030]	[0.064]	[0.050]	[0.017]	[0.016]	[0.027]	[0.023]
$Treat$	-0.032	-0.032	-0.018	-0.022	0.040	0.043	0	0
	[0.043]	[0.043]	[0.071]	[0.059]	[0.024]	[0.032]	[.]	[.]
$ln(Y)$	0.86***	0.85***	0.86***	0.85***	0.31***	0.30***	0.25***	0.24***
	[0.028]	[0.029]	[0.037]	[0.034]	[0.051]	[0.049]	[0.063]	[0.059]
$ln(w_l)$	0.53***	0.53***	0.35***	0.37***	0.57***	0.56***	0.57***	0.57***
	[0.083]	[0.085]	[0.10]	[0.096]	[0.040]	[0.040]	[0.056]	[0.056]
$ln(w_o)$	0.31***	0.30***	0.37***	0.36***	0.30***	0.32***	0.31***	0.31***
	[0.039]	[0.040]	[0.054]	[0.051]	[0.024]	[0.024]	[0.036]	[0.035]
$ln(N)$	0.11***	0.11***	0.13***	0.14***	0.040***	0.038***	0.053***	0.052***
	[0.029]	[0.030]	[0.038]	[0.036]	[0.013]	[0.013]	[0.016]	[0.015]
$Constant$	-4.12***	-4.11***	-3.94***	-3.91***	2.40***	2.57***	3.12***	3.24***
	[0.30]	[0.31]	[0.40]	[0.35]	[0.62]	[0.60]	[0.75]	[0.69]
Network fixed-effects	No	No	No	No	Yes	Yes	Yes	Yes
N	763	733	461	501	763	733	461	501
R2-adjusted	0.93	0.93	0.93	0.93	0.82	0.83	0.83	0.83

Standard errors in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The monetary variables C, w_l and w_o have been normalized with respect to the factor price w_m to ensure that the costs function is homogeneous of degree one in input prices.

Table 6: Difference-in-differences estimation excluding the years 2009-2010

	C1	C2	C3	C4	C1	C2	C3	C4
$Post \times Treat$	0.099*	0.11*	0.13	0.14*	0.031	0.032	0.044	0.041
	[0.055]	[0.058]	[0.082]	[0.071]	[0.030]	[0.029]	[0.040]	[0.038]
$Post$	-0.010	-0.019	-0.047	-0.052	0.087***	0.088***	0.082***	0.086***
	[0.032]	[0.036]	[0.071]	[0.058]	[0.020]	[0.019]	[0.031]	[0.027]
$Treat$	-0.055	-0.055	-0.052	-0.059	0.035	0.028	0	0
	[0.043]	[0.042]	[0.067]	[0.057]	[0.027]	[0.034]	[.]	[.]
$ln(Y)$	0.86***	0.85***	0.85***	0.84***	0.30***	0.29***	0.23***	0.22***
	[0.028]	[0.029]	[0.036]	[0.033]	[0.051]	[0.048]	[0.064]	[0.058]
$ln(w_l)$	0.52***	0.52***	0.35***	0.37***	0.56***	0.55***	0.58***	0.58***
	[0.084]	[0.086]	[0.10]	[0.095]	[0.051]	[0.052]	[0.072]	[0.071]
$ln(w_o)$	0.30***	0.29***	0.35***	0.34***	0.30***	0.31***	0.29***	0.28***
	[0.037]	[0.038]	[0.052]	[0.048]	[0.025]	[0.026]	[0.041]	[0.039]
$ln(N)$	0.10***	0.10***	0.13***	0.14***	0.037**	0.035**	0.052**	0.050**
	[0.030]	[0.031]	[0.038]	[0.037]	[0.015]	[0.017]	[0.021]	[0.020]
$Constant$	-4.14***	-4.12***	-3.95***	-3.92***	2.51***	2.71***	3.22***	3.34***
	[0.29]	[0.29]	[0.37]	[0.33]	[0.63]	[0.59]	[0.75]	[0.69]
Network fixed-effects	No	No	No	No	Yes	Yes	Yes	Yes
N	597	567	359	391	597	567	359	391
R2-adjusted	0.93	0.93	0.93	0.93	0.80	0.81	0.81	0.81

Standard errors in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The monetary variables C, w_l and w_o have been normalized with respect to the factor price w_m to ensure that the costs function is homogeneous of degree one in input prices.

Table 7: Difference-in-differences estimation with no condition on input prices

	C1	C2	C3	C4	C1	C2	C3	C4
$Post \times Treat$	0.068	0.077	0.093	0.098	0.026	0.027	0.027	0.031
	[0.045]	[0.048]	[0.071]	[0.061]	[0.023]	[0.023]	[0.035]	[0.031]
$Post$	-0.016	-0.025	-0.059	-0.054	0.084***	0.082***	0.089***	0.088***
	[0.028]	[0.031]	[0.062]	[0.050]	[0.016]	[0.016]	[0.028]	[0.022]
$Treat$	-0.026	-0.025	-0.0079	-0.011	0.018	0.026	0	0
	[0.042]	[0.042]	[0.073]	[0.061]	[0.025]	[0.031]	[.]	[.]
$ln(Y)$	0.85***	0.84***	0.83***	0.83***	0.33***	0.32***	0.25***	0.24***
	[0.033]	[0.034]	[0.043]	[0.040]	[0.053]	[0.052]	[0.065]	[0.060]
$ln(w_l)$	0.65***	0.67***	0.61***	0.55***	0.37***	0.39***	0.40***	0.37***
	[0.17]	[0.17]	[0.21]	[0.19]	[0.063]	[0.065]	[0.080]	[0.074]
$ln(w_m)$	0.19***	0.19***	0.33***	0.31***	0.10***	0.097***	0.087**	0.088**
	[0.066]	[0.068]	[0.082]	[0.079]	[0.034]	[0.034]	[0.036]	[0.037]
$ln(w_o)$	0.31***	0.31***	0.39***	0.37***	0.28***	0.29***	0.27***	0.27***
	[0.043]	[0.044]	[0.061]	[0.056]	[0.028]	[0.029]	[0.045]	[0.042]
$ln(N)$	0.11***	0.11***	0.13***	0.14***	0.039***	0.038***	0.054***	0.051***
	[0.029]	[0.030]	[0.037]	[0.035]	[0.013]	[0.014]	[0.016]	[0.014]
$Constant$	-4.50***	-4.56***	-4.73***	-4.44***	3.03***	3.11***	3.77***	3.96***
	[0.46]	[0.46]	[0.59]	[0.55]	[0.66]	[0.64]	[0.74]	[0.68]
Network fixed-effects	No	No	No	No	Yes	Yes	Yes	Yes
N	763	733	461	501	763	733	461	501
R2-adjusted	0.94	0.94	0.95	0.95	0.73	0.73	0.66	0.66

Standard errors in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Difference-in-differences estimation with heterogenous treatment effects

	C1	C2	C3	C4	C1	C2	C3	C4
$Post \times Treat$	0.061	0.074	0.088	0.10	0.017	0.017	0.010	0.011
	[0.049]	[0.051]	[0.081]	[0.066]	[0.025]	[0.025]	[0.039]	[0.034]
$Post \times Treat \times CP$	0.17	0.13	0.100	0.062	0.020	0.064*	0.067	0.064
	[0.13]	[0.11]	[0.12]	[0.11]	[0.060]	[0.038]	[0.045]	[0.040]
$Post$	-0.0065	-0.019	-0.041	-0.052	0.073***	0.075***	0.087***	0.088***
	[0.028]	[0.031]	[0.073]	[0.054]	[0.017]	[0.016]	[0.031]	[0.025]
$Post \times CP$	-0.074	-0.035	0.020	0.053	0.0053	-0.054***	-0.065*	-0.064**
	[0.067]	[0.055]	[0.070]	[0.058]	[0.047]	[0.016]	[0.033]	[0.025]
$Treat$	-0.036	-0.037	-0.030	-0.036	0.027	0.031	0	0
	[0.046]	[0.046]	[0.077]	[0.064]	[0.027]	[0.031]	[.]	[.]
$Treat \times CP$	0.057	0.058	0.12	0.15	0.063	0.15**	-0.0044	-0.0025
	[0.11]	[0.10]	[0.12]	[0.12]	[0.064]	[0.070]	[0.047]	[0.047]
CP	-0.039	-0.037	-0.098	-0.11*	-0.057	-0.10**	0	0
	[0.052]	[0.051]	[0.075]	[0.068]	[0.051]	[0.047]	[.]	[.]
$ln(Y)$	0.86***	0.85***	0.85***	0.84***	0.31***	0.30***	0.25***	0.23***
	[0.029]	[0.030]	[0.038]	[0.035]	[0.051]	[0.050]	[0.064]	[0.059]
$ln(w_l)$	0.53***	0.52***	0.35***	0.37***	0.57***	0.56***	0.57***	0.57***
	[0.083]	[0.085]	[0.10]	[0.095]	[0.040]	[0.041]	[0.056]	[0.056]
$ln(w_o)$	0.31***	0.30***	0.37***	0.36***	0.30***	0.32***	0.31***	0.31***
	[0.039]	[0.040]	[0.054]	[0.051]	[0.024]	[0.025]	[0.037]	[0.035]
$ln(N)$	0.11***	0.11***	0.14***	0.15***	0.040***	0.038***	0.053***	0.052***
	[0.030]	[0.030]	[0.037]	[0.035]	[0.013]	[0.014]	[0.016]	[0.015]
$Constant$	-4.12***	-4.10***	-3.91***	-3.88***	2.42***	2.64***	3.12***	3.25***
	[0.31]	[0.31]	[0.41]	[0.36]	[0.63]	[0.60]	[0.75]	[0.69]
Network fixed-effects	No	No	No	No	Yes	Yes	Yes	Yes
N	763	733	461	501	763	733	461	501
R2-adjusted	0.93	0.93	0.93	0.93	0.82	0.83	0.83	0.83

Standard errors in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The monetary variables C, w_l and w_o have been normalized with respect to the factor price w_m to ensure that the costs function is homogeneous of degree one in input prices.