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**Working Paper**

## Consolidations in the German interurban bus industry: Effects on prices and quantities

MAGKS Joint Discussion Paper Series in Economics, No. 31-2017

**Provided in Cooperation with:**

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*Suggested Citation:* De Haas, Samuel; Schäfer, Jan Thomas (2017) : Consolidations in the German interurban bus industry: Effects on prices and quantities, MAGKS Joint Discussion Paper Series in Economics, No. 31-2017, Philipps-University Marburg, School of Business and Economics, Marburg

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**MAGKS**



**Joint Discussion Paper  
Series in Economics**

by the Universities of  
**Aachen · Gießen · Göttingen  
Kassel · Marburg · Siegen**

ISSN 1867-3678

**No. 31-2017**

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# Consolidations in the German interurban bus industry: Effects on prices and quantities

Samuel de Haas<sup>\*†</sup>      Jan Thomas Schäfer<sup>\*‡</sup>

July 25, 2017

## Abstract

We study effects on prices and quantities of a takeover in the rather concentrated German interurban bus industry. We empirically assess the effect of the takeover of Postbus by Flixbus on industry key features, using a route-level price data set containing prices for more than 6,000 routes in Germany for a period between September and December 2016. We find that average prices significantly increase and quantities decrease in the post-takeover phase. However, these results are mainly driven by the fact that Postbus was a low-cost supplier. The remaining providers do not seem to have increased their prices significantly in the post-takeover phase. This absence of a price increase despite the removal of a close competitor could be an indication of a strong impact of intermodal competition. This suggestion is confirmed by our empirical findings.

**JEL codes:** L11, L41, L92, K21, K23

**Keywords:** Competition, Takeover, Interurban Bus Services, Germany

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# 1 Introduction

In Germany, interurban bus services have been opened to full competition in the beginning of 2013. Since that the market has grown very dynamically. Compared to the level before the liberalization the number of passengers carried has more than tenfold, reaching 24 million in 2016.

In the first two years after the liberalization the industry was characterized by a high degree of price competition. Several companies have entered the market and the network of operators was steadily expanded. With the market exit of City2City in the end of 2014, a consolidation phase began. In the beginning of 2015 the market environment then changed significantly by the merger of the two largest operators Flixbus and MeinFernbus, now operating under the Flixbus brand. The company became the largest operator and took over competitors like the British Megabus. In the end of 2016 Flixbus reached a market share of more than 70 percent in interurban bus services, when the company announced the takeover of Postbus, the largest remaining competitor. The takeover took place with effect of November 1st, 2016. At the same time, BerlinLinienBus, a subsidiary of Deutsche Bahn, stopped services. They argued that profitability was too low and left Flixbus with a market share of more than 90 percent.

Market opening has progressed differently in the member states of the EU. Most recently, France followed in the End of 2015. Augustin et al. (2014) compared the development of the industries between Germany and the United States, where bus services have been deregulated since the 1980th. Likewise, van de Velde (2009) compared market developments between several European countries like Germany, the U.K., Sweden and others. Furthermore there are several studies that deal with the deregulation of the interurban bus industry in countries such as Italy (Beria et al., 2014), the U.K. (White and Robbins, 2012) and Norway (Aarhaug and Fearnley, 2016).

Additionally, there are several studies that have dealt with previous developments in the German market. Dürr and Hüschelrath (2015) have analyzed the industry two years after

its liberalization with a focus on the number of companies, number of offered connections as well as fares. They also address topics such as market concentration with regard to upcoming mergers as well as the abuse of market power by incumbents. Another paper of Dürr et al. (2016) studied these topics in a more empirical framework. They predict potential price effects of an announced merger in 2015, before the merger took place. They suggested that route-level average prices would increase due to this merger. Knorr and Lueg-Arndt (2016) analyzed market developments due to the deregulation of German interurban bus industry, both intramodal as well as intermodal. They expected that substantial economic benefits were likely to occur to the travelling public and society as a whole. Böckers et al. (2015) estimated effects of the liberalization in the German interurban bus industry on long-distance rail connections and suggested a strong competitive effect. Beestermöller (2017) used a data set on railway strikes to study corresponding effects on the interurban bus industry. He found a persistent effect on the ticket sales for interurban buses on the affected routes. Bataille and Steinmetz (2013) used a theoretical model to study competition of buses and railways. In line with expectations, they showed that interurban buses competing on a few routes against trains within an established railway network can lead to unprofitable train service on these routes.

We study the effects of the latest consolidation, i.e., takeover of Postbus by Flixbus as well as the market exit of BerlinLinienBus, on prices and quantities. Therefore, we provide an empirical assessment, using a route-level price data set containing prices for more than 6,000 routes in Germany for a period between September and December 2016. In contrast to Dürr et al. (2016), who used a traditionally two-stage approach to overcome potential issues arising from endogeneity, we estimate price effects due to takeover using a heteroscedacity based instrumental variable approach as suggested by Lewbel (2012). This approach also enables us to observe the pricing behavior of operators before and after the recent consolidation. The main focus of the analysis is to examine whether Flixbus is taking advantage of its market position in order to achieve higher prices after takeover of Postbus and market exit

of BerlinLinienBus. We find that average prices significantly increase and quantities decrease, respectively, in the post-takeover phase. However, these results are mainly driven by the fact, that Postbus and BerlinLinienBus were low-cost suppliers. It does not seem to be the case that the remaining providers increase their prices significantly in the post-takeover phase. This absence of a price increase despite the removal of close competitors is surprising and not in line with standard theory. These results could be an indication of a strong impact of intermodal competition, which is also supported by our empirical results.

The analysis is structured as follows. In Section 2 we outline some facts about the German interurban bus industry for different periods in time. In Section 3 we present our data, descriptive statistics and empirical findings of industry key features. Section 4 concludes.

## **2 The German Interurban Bus Industry**

### **2.1 Period I: Prior 2013**

Prior the liberalization in 2013, the German interurban bus market was characterized by a very limited route network. This was due to regulations that had been introduced to protect rail traffic from competition. Only international connections and connections from and to former West Berlin were permitted. In addition to these connections there were few routes for which one could receive an approval, e.g. Airport Shuttles. BerlinLinienBus (BLB), a Deutsche Bahn subsidiary, and Deutsche Touring were the two largest companies on the market at the time before the liberalization. In course of the political discussion about liberalization of the market, DeinBus started offering regular bus services using a legal loophole in December 2009. The connections were organized as carpool rides, and have been approved by a court decision in 2011. In April 2012 MeinFernbus began to operate its first route after an official approval being granted.

## **2.2 Period II: 2013 - 2014**

With effect of January 1st, 2013 market was opened to competition. According to the amended version of the German Passenger Transport Act (Personenbeförderungsgesetz), all connections may be approved where there is at least a distance of 50 kilometers between two successive stops. An exemption for shorter connections may be granted where no regional train connection with a travel time of less than one hour is operated, if there are insufficient local transport services or if there is only minor passenger loss expected.

Since liberalization the market has grown very dynamically and several companies have entered the market. The resulting high competitive pressure forced some suppliers to leave the market or to be taken over by larger competitors (see Bundesamt für Güterverkehr 2015, 2016 for a comprehensive overview of entries and exits). In February 2013 Flixbus, which is now one of the largest operators, entered the Market. City2City, a subsidiary of the British National Express, started operation in April 2013. In November 2013 ADAC Postbus, a joint venture of the automobile club ADAC and Deutsche Post, started regular services. In contrast to Flixbus and MeinFernbus, which focused their strategy on low income groups like students, ADAC Postbus addressed more demanding customers at that time.

In October 2014 City2City was one of the first operator to stop services. One month later, in November 2014, ADAC withdrew from joint venture with Deutsche Post. As a result, Deutsche Post continued operating alone under the brand name Postbus. Since high quality / high price policy did not meet expectations, pricing policy was changed to be more competitive. A discount card was introduced and promo fares were offered on a regular basis. The operator Megabus, which is part of the British Stagecoach Group, entered the market in December 2014.

## **2.3 Period III: 2015 - Fall 2016**

In the beginning of 2015 the environment of the market has changed significantly by the merger of the two biggest operators Flixbus and MeinFernbus, now operating under the

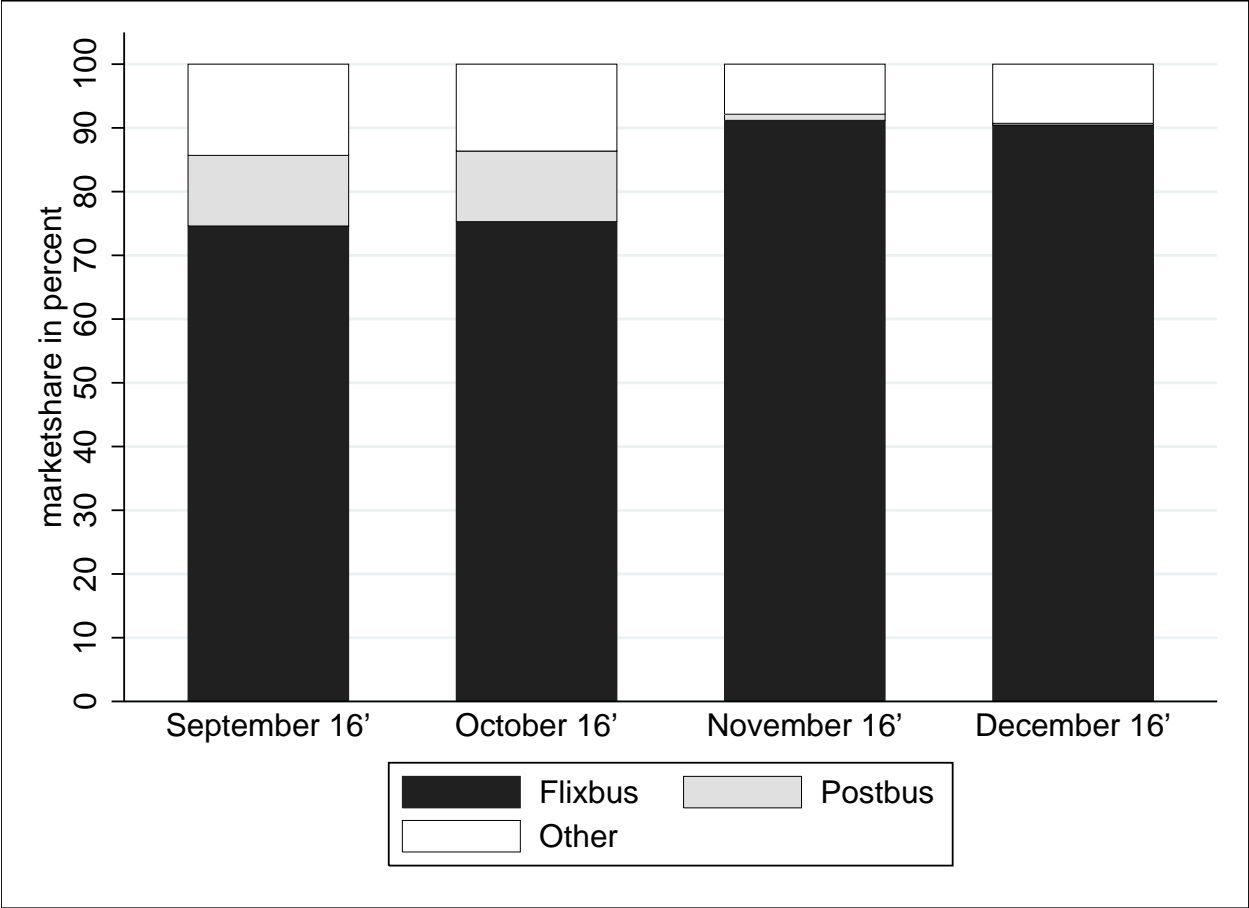


Figure 1: Market Share before and after the October/November 2016 consolidation

Flixbus brand. During the transition period the company was named "MeinFernbus Flixbus" and buses were painted accordingly. Later on management decided to rename the brand to Flixbus. In Summer 2016 Flixbus announced the takeover of Megabus. At this point the two main competitors of Flixbus were Postbus and BerlinLinienBus. However, due to low profitability BerlinLinienBus stopped operating in November 2016 and Postbus was taken over by Flixbus on 1st of November, 2016. As shown in Figure 1, Flixbus has now a quasi-monopoly as far as only smaller competitors, which operate solely on a regional level (e.g. DeinBus), are left in the interurban bus industry. While the licenses for the Postbus routes were taken over by Flixbus, a small number of BerlinLinienBus routes will be operated by IC Bus, another Deutsche Bahn subsidiary. In case of the Postbus takeover it should be noted that a small number of routes to airports is still being operated under the Postbus brand,



ending in the beginning of 2017. Flixbus announced that they will start to include former Postbus connections into their network in the end of 2016.

## 3 Empirical Analysis

### 3.1 Data

We are using data that was mainly obtained from `busliniensuche.de`, one of the leading online search engines for interurban bus travel in Germany. Our data includes information on travel date, provider, city of origin and destination as well as on duration and prices of more than 8,000 routes<sup>1</sup> in Germany. After excluding routes that are offered less than once per week and provider, 6,105 routes remain for our analysis. Moreover, this search engine also provides additional data about train connections and stops of Deutsche Bahn. There is also information about share car journeys offered on the biggest online platform, BlaBlaCar<sup>2</sup>. Hence, we can control for price effects due to the prevalence of parallel railway connections and share car journeys, respectively.

For our analysis, we distinguish between three providers, i.e., Flixbus (FB), Postbus (PB) and Others (OT). Thereby, OT summarizes all other providers then FB and PB, e.g., BerlinLinienBus (BLB) or Deinbus. We collected average prices, separated by providers, for each route and day in the observation period from 5th of September 2016 until 11th of December 2016. We use data collected five days<sup>3</sup> prior to the respective day of departure. We started to collect data within this framework before BLB announced its market exit. Thus, we are not able to distinguish between BLB and other providers summarized by OT. However, this paper mainly focusing the policy of FB and hence, our main results are not

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<sup>1</sup>Following Dürr et al. (2016), we define routes as each combination between two different stops on a line (e.g. Hamburg to Munich) and count outward and inward trips as two separate routes. If one provider offers the same route more than one times per day, we aggregate data on provider level per day and focus on average prices.

<sup>2</sup><https://www.blablacar.de/>

<sup>3</sup>As already discussed by Dürr and Hüschelrath (2015), the data structure was found not to vary much if collected more or less days in advance.

affected by this.

### 3.2 Descriptive Statistics

Prior the takeover the average price for using an interurban bus service was €15.71 and the average price per kilometer (km) was 5.67 cents. Analyzing the competitive environment before the takeover, we split the overall number of routes into 6 subgroups and provide price data for the pre-takeover phase:

1. 3,851 routes provided only by FB (on average 6.08 cents/km)
2. 219 routes provided only by PB (4.33 cents/km)
3. 402 routes provided by FB and PB (4.96 cents/km)
4. 658 routes provided by FB and OT (6.37 cents/km)
5. 134 routes provided by PB and OT (5.72 cents/km)
6. 839 routes provided by FB, PB and OT (5.07 cents/km)

After the takeover three types of routes remain: FB monopoly routes (potentially including routes of group 1, 2 and 3), routes of FB and OT (potentially including routes of group 4, 5 and 6) and routes only operated by OT (potentially including routes of group 4, 5 and 6 that are not operated by FB anymore). Focusing on subgroup 2, we find that FB operates only 5 former PB routes. In subgroups 3 and 6, FB was already active before. However, the number of served routes has decreased significantly. This is based on the fact that most of the trips formerly operated by PB are not offered by FB anymore, after the takeover. Additionally, FB reduced the number of routes served by their own already before the takeover. In total 5251 routes are still operated, of which:

- 4479 routes provided only by FB (on average 5.90 cents/km)
- 717 routes provided by FB and OT (6.12 cents/km)

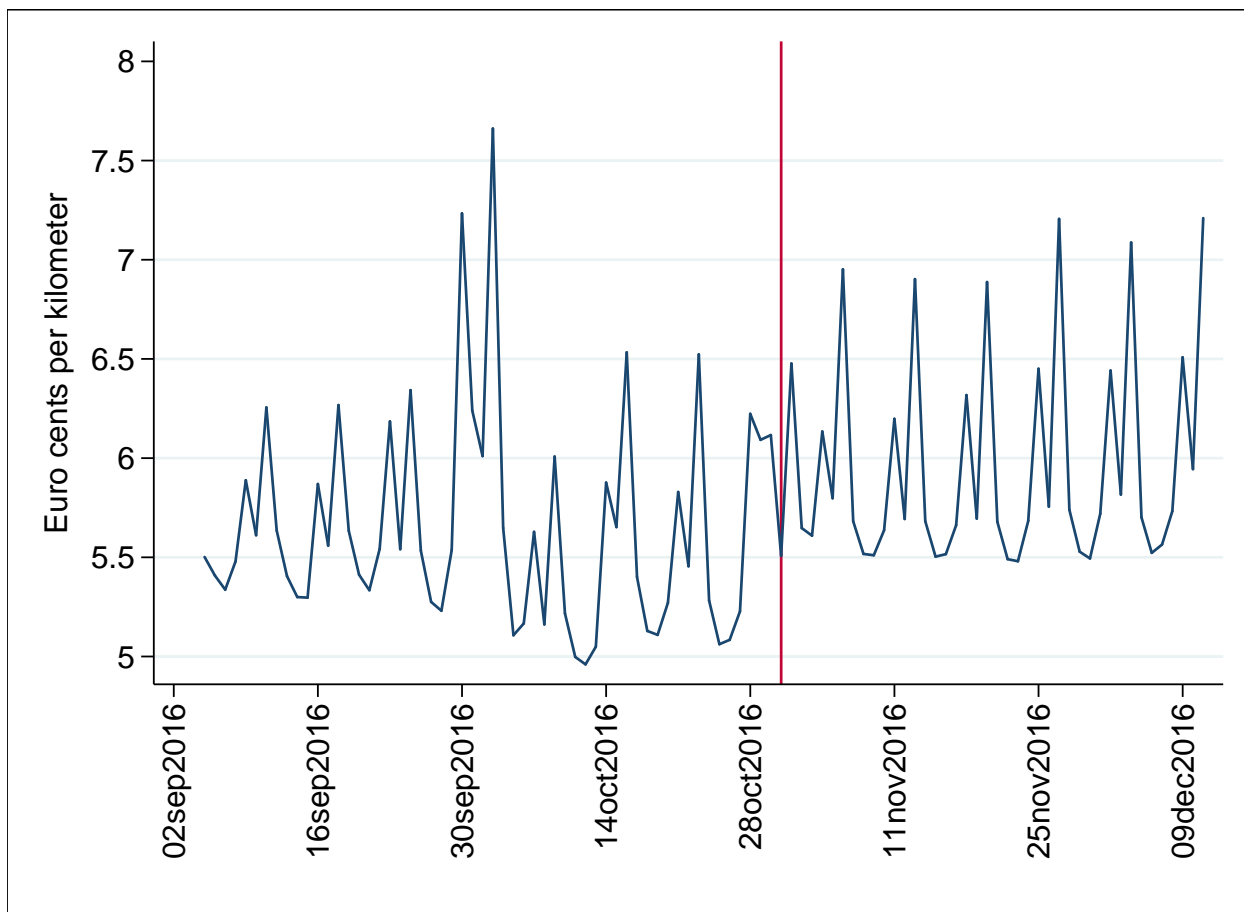


Figure 2: Average price in Euro Cents per kilometer<sup>4</sup>

- 55 routes provided only by OT (14.55 cents/km)<sup>5</sup>

An overview of price effects within the respective groups is given by Figure 3<sup>6</sup>. The increase of prices at 3rd of October and previous weekend (public holiday as discussed below) is visible in all subgroups. Additionally, on average there is a price effect (increasing) in the post-takeover phase in all subgroups. In group 1 the upper bound of average prices is increasing. One possible reason is that the potential entrant PB is missing in that period and thus, not disciplining incumbent prices. In group 2 the effect is influenced by the fact, that FB took over only a few routes - potentially only profitable ones with on average higher

<sup>4</sup>The vertical line represents the date of the takeover / market exit. A corresponding figure with average price per competitor instead of overall price is presented in the Appendix.

<sup>5</sup>Average prices in this group are very high, since most of the routes are unusual ones that are rarely served. For example small sections (Dresden to Görlitz) of larger international connections.

<sup>6</sup>A corresponding figure with average price per competitor is presented in the Appendix.

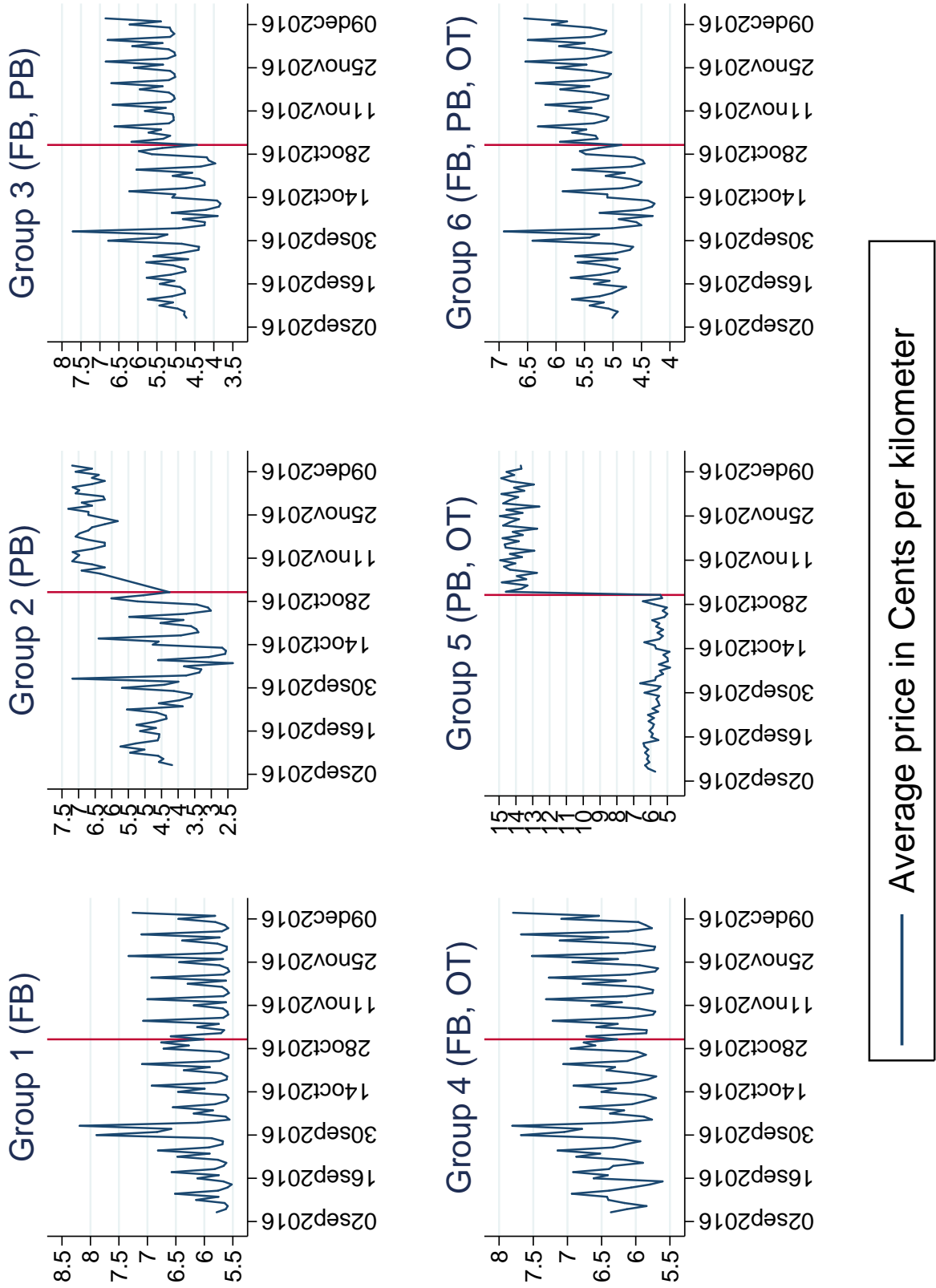


Figure 3: Price effects by groups in Euro Cents per kilometer

prices. In group 3, PB as low-cost supplier lowers the average price in the pre-takeover phase. However, it might also be the case that FB increased its own prices after takeover. Price effects in group 4 are qualitatively similar to the ones in group 1. These effects are potentially driven by the market exit of BLB. However, as discussed above, we are not able to control for the market exit of BLB given our data structure. Group 5 shows the most extreme price effects. As in group 2, this is influenced by the fact that FB took over only a few (potentially profitable) routes. Of course, prices are also increasing in this group due to market exit of BLB, that offered relatively low prices before exiting the market. Additionally, remaining providers potentially increased their own prices on the routes that are not covered by FB. In group 6 average prices are also increasing after takeover. The average price increase in group 6 is driven by the fact, that two competitors (PB and BLB) exited the market in this subgroup.

Summarizing, prices are increasing on average in the post-takeover phase. However, there are two potential reasons: On the one hand, PB and BLB were low-cost suppliers and thus, lowered average prices before takeover. On the other hand, FB and OT might have increased their own prices due to decreased competition after the takeover. We try to test these hypotheses in the empirical analysis below.

### 3.3 Effects on Prices: Empirical Analysis

In our empirical analysis we estimate the impact of the takeover on prices. In a first step, we analyze the impact on average interurban bus prices and on potential changes in the price policy of FB, by using a fixed effects panel regression. The structural equation of our model has the following form:

$$\ln p_{i,j,t} = X_t' \beta_1 + \delta_1 D_{TO,t} + \delta_2 D_{PB,j} + \delta_3 D_{FB,j} + \delta_4 D_{FB,j} D_{TO,t} + \alpha_i + \epsilon_{i,j,t} \quad (1)$$

The dependent variable is the logarithm of daily average prices per km. Prices are given

for each route  $i$  and provider  $j$  at day  $t$ . The matrix  $X_t$  includes dummies for each day of the week (Dürr et al., 2016). Given that Monday, the 3rd of October 2016 was a national public holiday in Germany, we include also a dummy variable to control for corresponding price effects at this day and the weekend before.  $D_{TO,t}$  is a dummy variable that assumes the value 0 before and 1 after the takeover. We also include dummy variables,  $D_{PB,j}$  ( $D_{FB,j}$ ), that take the value 1 if PB (FB) is the corresponding provider. Hence, we are able to control for PB's (FB's) overall price policy compared to other providers. The interaction term,  $D_{FB,j} * D_{TO,t}$ , determines takeover effects on prices of FB. Thus, we are able to analyze not only average price effects due to takeover, but also if FB changes its price policy in the post-takeover phase. All time-invariant heterogeneity between different routes, e.g. sociodemographic characteristics of the cities, is absorbed by the route fixed effects  $\alpha_i$ .<sup>7</sup> Table 1 presents the results of our regression. In total we have 664,165 observations.

As also shown by Dürr et al. (2016), we find a strong increase of average prices on Fridays and Sundays. This fact represents higher demand for interurban bus services on weekends. As additionally shown in Figure 3, on the public holiday weekend prices increase even more than on normal weekends. That is represented by high and significant coefficients for  $D_{Friday}$ ,  $D_{Sunday}$  and  $D_{PH}$ .

We now focus on providers' price setting behavior before and after the takeover. As shown by  $D_{PB}$ , PB was clearly a low-cost provider: On average PB's prices were about 36.7% below prices of other providers. Whereas, FB prices are only slightly and not significant below prices of other providers, as shown by  $D_{FB}$ . After takeover, average prices are increasing about 6.6% on average ( $D_{TO}$ ). However, these increases are likely to be based on the fact that PB and BLB, as providers with prices below average, exit the market.<sup>8</sup> The interaction term,  $D_{FB} * D_{TO}$ , represents the post-takeover price policy of FB. Its shown, that the corresponding

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<sup>7</sup>Note, that we are not able to introduce time fixed effects, as we are in particular interested in the effects of the takeover. To control for a time trend, that is independent of the takeover, we apply a differences in differences approach by using share car journeys as control group. Corresponding results for both, prices and daily number of trips per route, are presented in the Appendix.

<sup>8</sup>Given that PB was active on about 1/5 of all routes, these numbers are quite reasonable.

	Coefficients	(Standard Errors)
$D_{Monday}$	0.0554***	(0.00137)
$D_{Wednesday}$	-0.00633***	(0.00106)
$D_{Thursday}$	0.0213***	(0.00109)
$D_{Friday}$	0.139***	(0.00171)
$D_{Saturday}$	0.0549***	(0.00124)
$D_{Sunday}$	0.188***	(0.00210)
$D_{PH}$	0.131***	(0.00139)
$D_{FB}$	-0.00976	(0.00728)
$D_{PB}$	-0.362***	(0.00819)
$D_{TO}$	0.0659***	(0.00886)
$D_{FB} * D_{TO}$	-0.0718***	(0.00896)
Constant	1.664***	(0.00638)
Observations	664,165	
$R^2$	0.291	

The estimation is performed by using a GMM. Dependent variable is daily average price per kilometer and is expressed in logarithm. The regression include route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for \*  $p < 0.5$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Table 1: Price determinants - Fixed effect panel regression results

negative marginal effect ( $D_{FB} * D_{TO}$ ) offsets the positive marginal effect of the takeover ( $D_{TO}$ ) on average prices.

However, the strategic decision to takeover a competitor or to exit the market, respectively, is likely to be influenced by expected profits and thus by prices. Hence, there are potential endogeneity problems in our regression. It seems to be hard to find any economically reasonable instruments for the takeover in order to follow a standard instrumental approach to tackle the potential endogeneity problems. Instead, we apply the heteroscedacity based instrumental variable (IV) approach as suggested by Lewbel (2012), to check robustness of our results. This method can be used to identify structural parameters in models with

endogenous regressors if no traditional identifying information, e.g., external instruments, are available. In this context, identification is achieved by having regressors that are uncorrelated with the product of heteroskedastic errors. Instruments are constructed as simple functions of the model’s data.<sup>9</sup> We use this method to instrument the potential endogenous variables  $D_{TO,t}$  and  $D_{TO,t} * D_{FB,j}$ . Table 2 presents the results of the corresponding Lewbel’s IV regression.

The Kleibergen-Paap statistic suggests that the based instruments are sufficiently strong, since the critical values for weak identification are exceeded by far<sup>10</sup>. Furthermore, the results of the estimation clearly confirm our prior findings.<sup>11</sup> To control for a time trend, that is independent of the takeover, we furthermore apply a differences in differences approach by using share car journeys as control group. Corresponding results are presented in the Appendix.

Summarizing, our results show that prices are increasing on average due to the takeover of PB and the market exit of BLB. However, our results suggest that price effects are mainly driven by the fact that PB and BLB were low-cost suppliers. They had relatively low prices and thus, average prices are increasing obviously in the post-takeover phase. In contrast, it does not seem to be the case that the remaining providers increase their prices significantly after the takeover and market exit. This absence of a price increase despite the removal of close competitors is surprising and not in line with standard theory, e.g., differentiated Bertrand competition or ‘Upward Pricing Pressure’ (Farrell and Shapiro, 1990). The latest consolidations leaves FB with a quasi-monopoly. Intramodal competition practically no longer exists. Thus, it seems to be that the relevant market has to be defined wider, i.e., intermodal. This is discussed in detail in the next section.

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<sup>9</sup>For a short introduction to this method we refer to Baum et al. (2012)

<sup>10</sup>The null hypothesis of the Kleibergen-Paap test is that the structural equation is under-identified (that is, the rank condition fails). Even though critical values do not exist for the Kleibergen-Paap statistic, the critical values calculated by Stock and Yogo (2002) are generally applied. As a rule of thumb a value of the test statistic above ten indicates identification of the model.

<sup>11</sup>As further robustness check, we apply the regression with interaction terms of the dummies in matrix  $X_t$  (days of the week) and the takeover dummy  $D_{TO}$ . As shown in the Appendix, the corresponding results are quite similar to the ones reported.



	Coefficients	(Standard Errors)
$D_{Monday}$	0.0571***	(0.000889)
$D_{Wednesday}$	-0.00421***	(0.000836)
$D_{Thursday}$	0.0235***	(0.000829)
$D_{Friday}$	0.142***	(0.000873)
$D_{Saturday}$	0.0555***	(0.000878)
$D_{Sunday}$	0.189***	(0.000948)
$D_{PH}$	0.133***	(0.00130)
$D_{FB}$	-0.0148***	(0.00111)
$D_{PB}$	-0.366***	(0.00155)
$D_{TO}$	0.0387***	(0.00225)
$D_{FB} * D_{TO}$	-0.0509***	(0.00238)
Observations	664,165	
$R^2$	0.291	

Weak identification test:

Kleibergen-Paap rk Wald F statistic 1.5e+05

Stock-Yogo (2002) critical values: 5% max. IV rel bias 20.33

10% max. IV size 43.22

$D_{TO}$  and its interaction term  $D_{FB} * D_{TO}$  are instrumented using Lewbel (2012) heteroscedasticity based IV method. The estimation is performed by using a 2-step GMM. Dependent variable is daily average price per kilometer and is expressed in logarithms. The regression include route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for \*  $p < 0.5$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Table 2: Price determinants - Lewbel's IV regression results

### 3.4 Intermodal Competition

Long-distance railway connections as well as share car journeys are the main competitors of the interurban bus industry in Germany. Moreover, on some routes like for example Cologne - Berlin as well as Munich - Berlin, flight connections exist. However, fares are usually far above fares for bus connections, if not booked several weeks in advance. This is why we focus the analysis on railways and share car journeys.

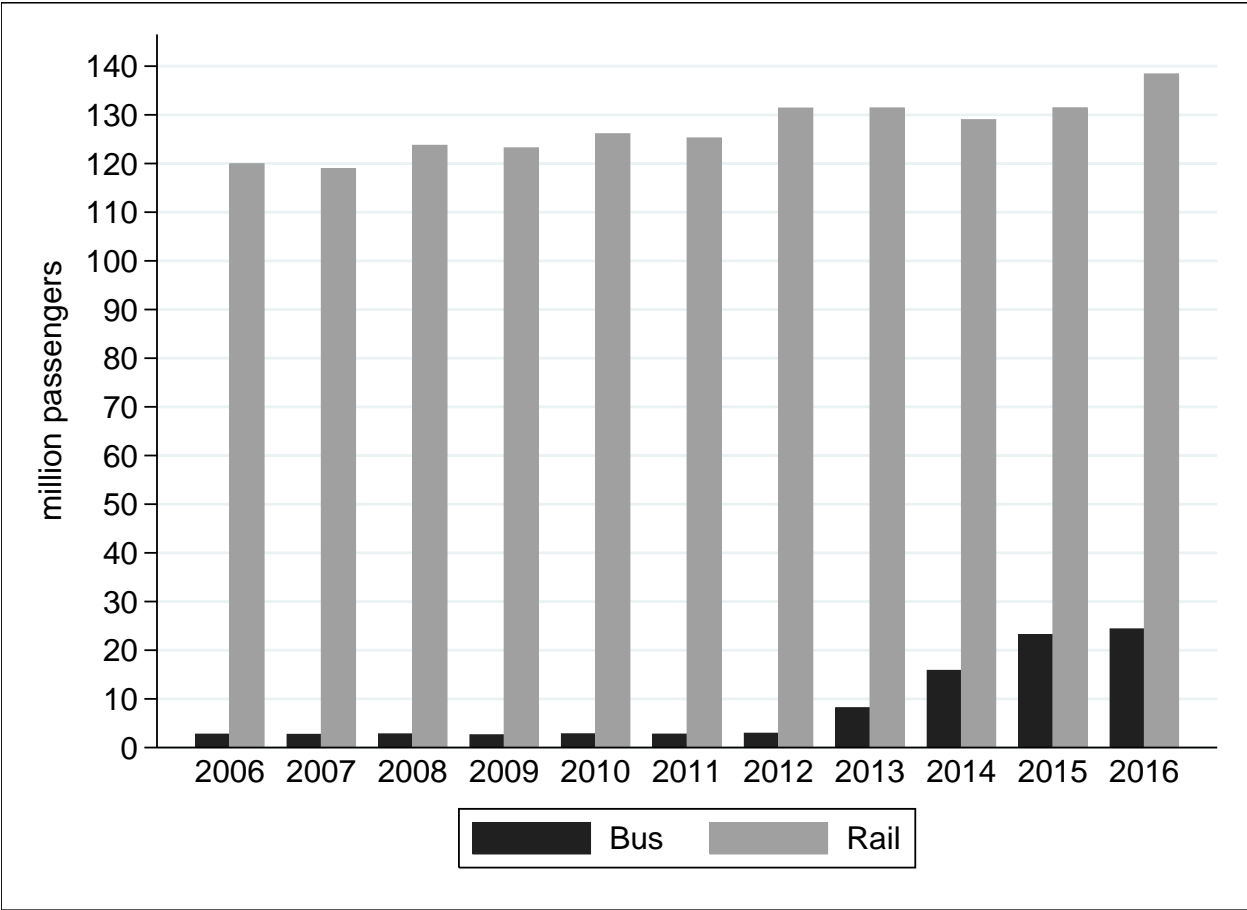


Figure 4: Number of passengers carried. Source: Federal Statistical Office of Germany. Values for 2016 are preliminary.<sup>12</sup>

Since the liberalization of the interurban bus industry there has been a steady growth in demand in this industry. As can be derived from Figure 4, the number of passengers carried has been doubled in 2013 and 2014, respectively. Compared to 2015, the number of passengers using interurban bus services has only grown by 5 percent in 2016. This could mean the end of the initial high-growth phase. At the same time, there has been a relatively strong increase in railway passengers. Figures are now above the level before the liberalization, after suffering from a passenger drop in 2014 and slightly recovering in 2015. Despite the fact that the number of passengers has been increasing in most recent years, railways are facing a revenue decline.

<sup>12</sup>Data available online: <https://goo.gl/vM8wct>. For 2016 date see press release of 21feb2017: <https://goo.gl/vEOX6z>.

We examine effects of the existence of parallel railway connections and share car journeys on interurban bus industry with an additional fixed effects panel regression. The structural equation of our this regression has the following form:

$$\ln p_{i,j,t} = X_i' \theta_1 + \gamma_1 D_{Rail,i,t} + \gamma_2 D_{SCJ,i,t} + \eta_t + \zeta_j + \mu_{i,j,t} \quad (2)$$

Again, the dependent variable is the logarithm of daily average prices per km. The matrix  $X_i$  includes the socio-demographic covariates population, share of population under 25 and private purchasing power in Euro for each route. Thereby, we simply take the sum of the covariates of both cities on the route. Additionally, we control for duration of journey (in minutes), distance and square distance (in meter) of the route. The dummy  $D_{RailDirect,i,t}$  takes the value 1 for each routes for which a parallel direct railway connection exists and 0 for others (Dürr et al., 2016).  $D_{RailChange,i,t}$  takes the value 1 for routes for which no direct parallel railway connection exists but a parallel connection with a maximum of one changeover.  $D_{SCJ,i,t}$  is a dummy variable that takes 1 if a share car journey is offered at day  $t$  on route  $i$ . All time-variant heterogeneity is absorbed by time fixed effects  $\eta_t$ . Heterogeneity between providers is absorbed by provider fixed effects  $\zeta_j$ . Furthermore, error terms are clustered on route level. Table 3 presents the results of our regression.

The coefficients related to the socio-demographic covariates as well as duration and distances are generally in line with the ones reported by Dürr et al. (2016). Given we use these variables only to control for heterogeneity on route-level, we refer to their paper for an in-depth discussion of the corresponding results.  $D_{RailDirect}$  and  $D_{RailChange}$  have negative and  $D_{SCJ}$  positive impact on prices. However, the effects are significant only for railways. Thus, the pure existence of a parallel railway connection limits the price setting behavior of companies that provide interurban bus services. These intermodal effects of railway connections lowers prices on average about 7.6% for direct connections and 4.9% for connections with one changeover, respectively. While railway connections and corresponding trips are

	Coefficients	(Standard Errors)
<i>Population</i>	-1.55e-08***	(2.92e-09)
<i>Population &lt; 25</i>	-0.871***	(0.226)
<i>PPP per Capita</i>	-0.00000214	(0.00000128)
<i>Duration</i>	0.000171***	(0.0000497)
<i>Distance</i>	-0.00000205***	(8.59e-08)
<i>Distance<sup>2</sup></i>	1.38e-12***	(8.05e-14)
<i>D<sub>RailDirect</sub></i>	-0.0758***	(0.00938)
<i>D<sub>RailChange</sub></i>	-0.0491***	(0.00861)
<i>D<sub>SCJ</sub></i>	0.0000248	(0.00336)
Observations	664,165	
<i>R<sup>2</sup></i>	0.454	

Dependent variable is daily average price per kilometer and is expressed in logarithm. The regression includes time fixed-effects as well as provider fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for \*  $p < 0.5$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Table 3: Price influences of railway - Fixed effect panel regression results

long-term planned and highly observable, share car journeys are often offered ad-hoc and irregularly. Thus, it seems to be hard for interurban bus companies to react strategically to private offered car journeys. This might be a reason for the small and insignificant effect of  $D_{SCJ}$  in our data.

### 3.5 Effects on Quantities

As already mentioned in Section 3.2, the number of routes operated has decreased after the recent consolidation. This is mainly due to the fact that most of the PB as well as BLB routes are not offered by FB or others after the takeover and market exit, respectively. Although FB took over all licenses of PB, they operate until now only a few of that routes which they did not operate before.

As is shown in Figure 5<sup>13</sup>, the average number of trips per day and route is also signifi-

<sup>13</sup>A corresponding figure with average number of trips per day by group and competitor is presented in

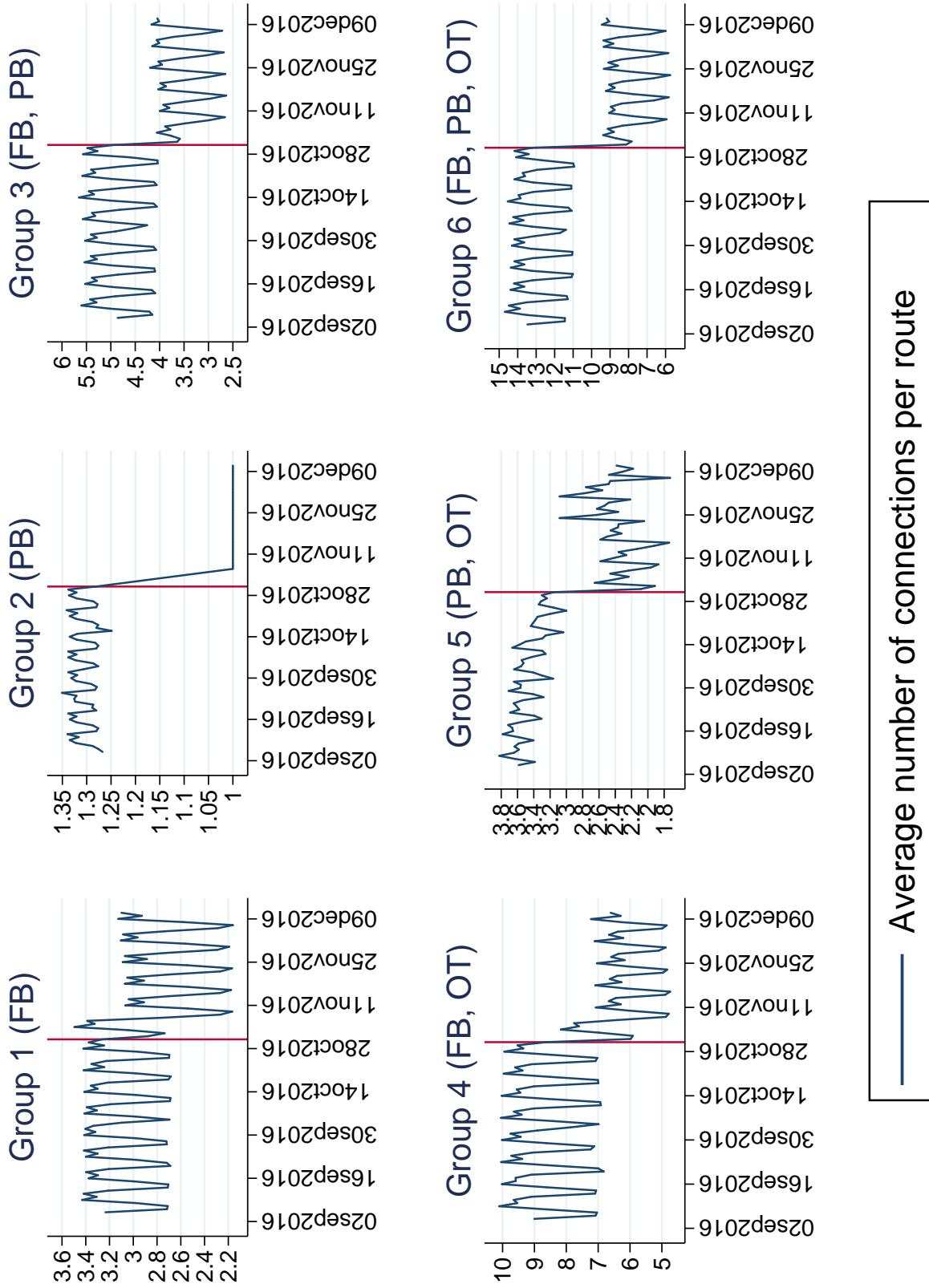


Figure 5: Effects on quantities over the period of observation

cantly smaller in the post-takeover phase:

- In group 1, FB has decreased the number of trips per day. Before the latest consolidation routes have been served on average 3.11 times per day, after the consolidation the daily frequency dropped to 2.75 trips per day. Thus, the drop in intramodal competition, i.e., the lack of a potential entrant, has an impact on competitive behaviour of FB on corresponding routes.
- Routes provided only by PB (group 2) have been served 1.31 times per day before takeover. Between November 1st, 2016 and November 5th, 2016 there has been no regular service on these routes. On November 6th, 2016 Flixbus started to serve a small number of former Postbus routes with an average of one connection per day. As described above, an interpretation of this result is not reliable, since FB operates only 5 routes after takeover.
- Routes that have been served by FB and PB (group 3) reached an average number of 4.91 trips per day before the takeover. Due to the termination of PB connections, the average number of trips per day dropped to 3.56. Hence, FB took over only a few connections of PB.
- On routes with FB and OT (group 4) the average number of trips before the consolidation amounted to 8.69 per day and 6.19 after takeover. This seems to be driven by the fact that BLB exited the market. Obviously, no other provider took over their connections.
- Likewise, routes served by PB and OT reached 3.46 trips per day before and 2.37 after the market exit of PB and BLB.
- On routes where all providers have been active, on average 13.01 trips have been offered per day before the consolidation and 8.10 after the recent consolidation. As for the

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the Appendix.

other groups not all connections of PB and BLB were taken over by other providers after they exited the market.

The data suggest that FB adjusted the number of services on routes that have been competitive before the takeover in order to reduce overcapacity (Dürr and Hüscherlath 2015). However, a strong reduction on routes where there has been no competitor before seems to be surprising.

In order to empirically confirm these suggestions, we apply an additional fixed effects panel regression. The structural equation of our model has the following form:

$$\ln q_{i,j,t} = X_t' \rho_1 + \lambda_1 D_{PB,j} + \lambda_2 D_{FB,j} + \lambda_3 D_{FB,j} D_{TO,t} + \alpha_i + \nu_{i,j,t} \quad (3)$$

The dependent variable is the logarithm of the number of trips offered by firm  $j$  on route  $i$  at day  $t$ . As above, the matrix  $X_t$  includes dummies for each day of the week a dummy for the public holiday.  $D_{PB,j}$  and  $D_{FB,j}$  are provider dummies. Given that a drop in quantities is plausible due to the market exits of PB and BLB, we do not include a single takeover dummy. However, the interaction term,  $D_{FB,j} * D_{TO,t}$ , determines takeover effects on quantities of FB. Thus, we are able to analyze if FB changes the number of trips per route and day in the post-takeover phase. All time-invariant heterogeneity between different routes, e.g. sociodemographic characteristics of the cities, is absorbed by the route fixed effects  $\alpha_i$ . Table 4 presents the results of our regression<sup>14</sup> To control for a time trend, that is independent of the takeover, we furthermore apply a differences in differences approach by using share car journeys as control group. Corresponding results are presented in the Appendix.

While PB offered similar numbers of trips per day and route as others, FB offer on average a 79% higher frequency, as shown by  $D_{PB}$  and  $D_{FB}$ . This illustrates once more FB's position as market leader. However, after the takeover, the frequency of FB trips per route

<sup>14</sup>For the same reasons as above we use Lewbel's IV method. The based instruments are sufficiently strong, as suggested by the Kleibergen-Paap statistic. However, we find no qualitative differences in the results by using a standard GMM method.

	Coefficients	(Standard Errors)
$D_{Monday}$	0.126***	(0.00194)
$D_{Wednesday}$	-0.0158***	(0.00211)
$D_{Thursday}$	0.105***	(0.00197)
$D_{Friday}$	0.199***	(0.00191)
$D_{Saturday}$	0.163***	(0.00190)
$D_{Sunday}$	0.187***	(0.00191)
$D_{PH}$	0.0214***	(0.00186)
$D_{FB}$	0.792***	(0.00262)
$D_{PB}$	0.00339	(0.00287)
$D_{FB} * D_{TO}$	-0.0942***	(0.00241)
Observations	664,165	
$R^2$	0.312	

Weak identification test:

Kleibergen-Paap rk Wald F statistic 1.9e+05

Stock-Yogo (2002) critical values: 5% max. IV rel bias 20.53

10% max. IV size 36.19

The interaction term  $D_{FB} * D_{TO}$  is instrumented using Lewbel (2012) heteroscedasticity based IV method. The estimation is performed by using a 2-step GMM. Dependent variable is daily average frequency of trips per route and provider is expressed in logarithms. The regression include route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for \*  $p < 0.5$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Table 4: Quantity determinants - Lewbel's IV regression results

drop about 9.5%. This is surprisingly, given FB take over only a small number of routes<sup>15</sup> which they did not operated before and thus, should have a lower frequency of trips. The vast majority of routes was operated by FB already before the takeover. It seems to be that FB kept the number of connections high in order to prevent potential competitors from entering the market and to protect profits (Schmalensee, 1978). After the takeover of PB and the exit of BLB, the strongest competitors left the market. Additionally, the high number of market exits might be driven by low margins and thus, is a bad signal for potential entrants.

<sup>15</sup>Group 2 and 5, as discussed in section 3.2.



The reduced competitive pressure leads FB to an adjustment of capacities on both, former competitive as well as non-competitive routes.

Following Redman et al. (2013) the number of trips per day and route is kind of a measurement of quality for transportation services. Thus, FB did not raise its actual prices but indeed lowers its 'product quality'. Whether these frequency adjustments are caused by a reduction of (social inefficient) overcapacity can not be verified by our data, since we have no data about actually passenger numbers. However, while the absolute prices of FB remain constant, the relative prices ('quality' adjusted) are increasing after the takeover.

## 4 Conclusion

The German interurban bus industry is characterized by a highly dynamic market environment since its liberalization in 2013. After a boom phase with a lot of market entries, one could observe several firms exiting the market in the last two years. In this paper, we analyzed recent consolidations, i.e., market exits of PB and BLB, and its effects on prices and quantities. While BLB exited the market due to low profitability, PB and its licenses were taken over by FB. FB has now a quasi-monopoly for interurban bus services in Germany with a market share above 90%. Thus, one would expect that FB would use its market power in order to raise prices after takeover.

Indeed, recent changes in the competitive environment have led to significant changes in average prices, number of routes as well as the number of trips offered per route and day. However, we found that this is mainly based on the fact that PB and BLB had relatively low prices before exiting the market. Thus, average prices are obviously increasing in the post consolidation phase. Nevertheless, we do not find evidence for a change in the pricing policy of FB or other providers. On the contrary, it seems to be the case that FB even lowered prices on some routes in order to be more attractive to former customers of PB and BLB. As discussed above, this behavior is surprising and not in line with standard theory (Farrell and

Shapiro, 1990). Thus, it seems to be that the relevant market has to be defined intermodal.

Due to the complete termination of PB and BLB services, the number of routes has been decreasing by around 850. At the same time, FB has been decreasing the frequency on routes where it was the only supplier (non-competitive) and on routes served also by others (competitive) before the consolidation. On the one hand, FB is reducing overcapacity by not replacing former PB trips on competitive routes. On the other, it seems to be the case that FB kept the number of connections artificially high before takeover, in order to prevent competitors from serving non-competitive routes (Schmalensee, 1978). Due to the market exit of the last major competitors, this competitive pressure is lowered. Intramodal competition prevails only on a few routes. These frequency adjustments can be stated as a drop in 'product quality', since the number of trips per day and route is a measurement of quality for transportation services (Redman et al., 2013).

Railways and share car journeys now seem to be the main competitors of FB. The existence of parallel rail connections have a negative impact on the level of prices of interurban bus services and thus seems to have a disciplining effect. Deutsche Bahn had initially underestimated the potential of the interurban bus market and suffered from a passenger drop in the early years of the liberalization. Nevertheless, the number of passengers carried has been growing relatively strong since the start of a price and service initiative. In 2016 the numbers were even higher than before market liberalization of interurban bus services. Policy makers now need to ensure that short-term competitive effects sustain in the long run. Otherwise there could be a risk that the liberalization has led to a creation of a strong competitor of subsidized rail services.

## **Acknowledgements**

We would like to thank Niklas Dürr, Justus Haucap, Paul Heidhues, Michael Hellwig, Georg Götz, Sven Heim, Daniel Herold and Peter Winker for discussing earlier versions of this

paper.

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## A Appendix

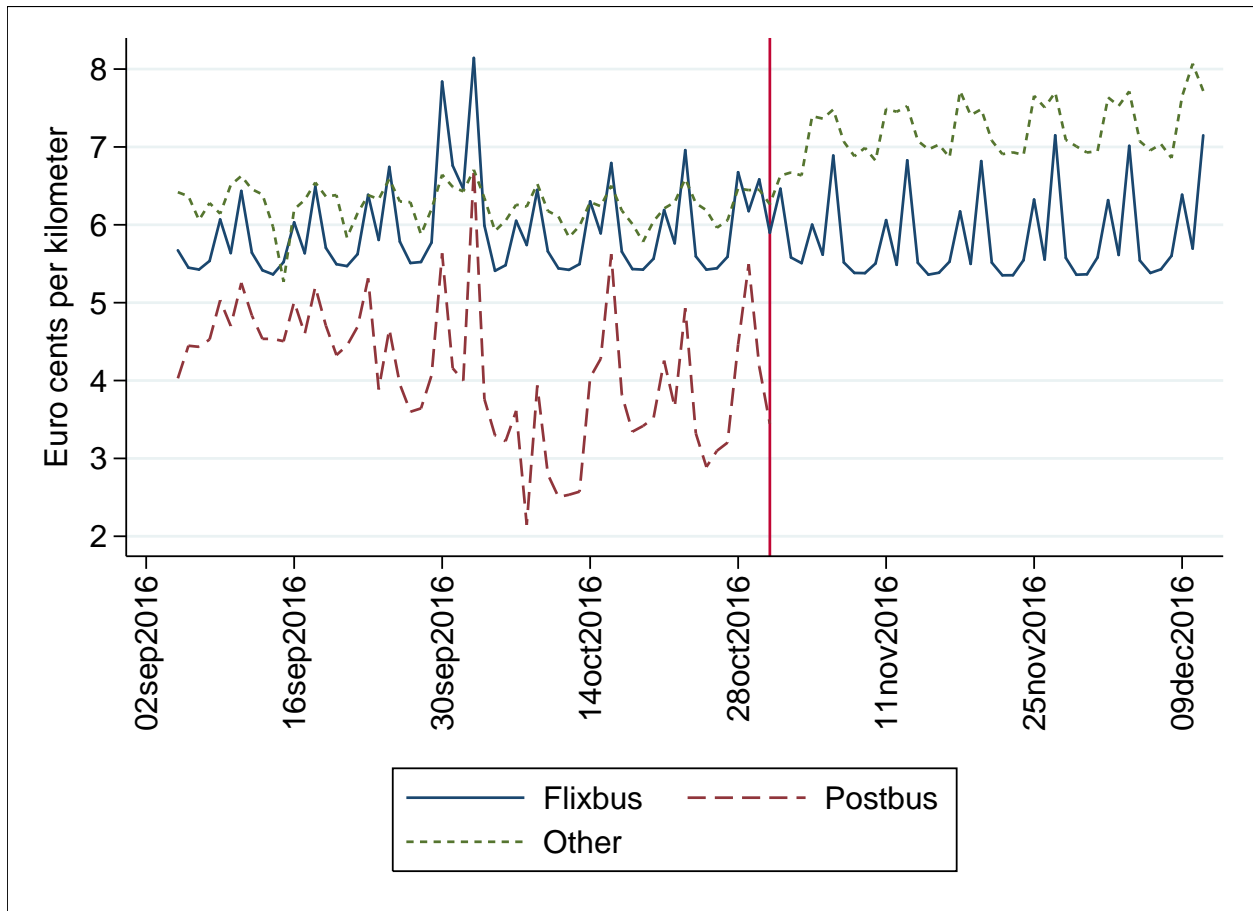


Figure 1: Average prices by operator in Euro Cents per kilometer

Figure 1 shows the average prices by operator in Euro Cents per kilometer. As discussed above, PB had relatively low prices on average. The price of OT are increasing after the market exit of BLB. However, for the prices of FB, no obvious trend emerges after the takeover.

Figure 2 shows average prices by group and operator. The corresponding price effects due to the takeover and market exit are discussed in detail in Section 3.2.

Figure 3 shows corresponding effects on the daily number of trips per route by group and operator, that are discussed in detail in Section 3.5.

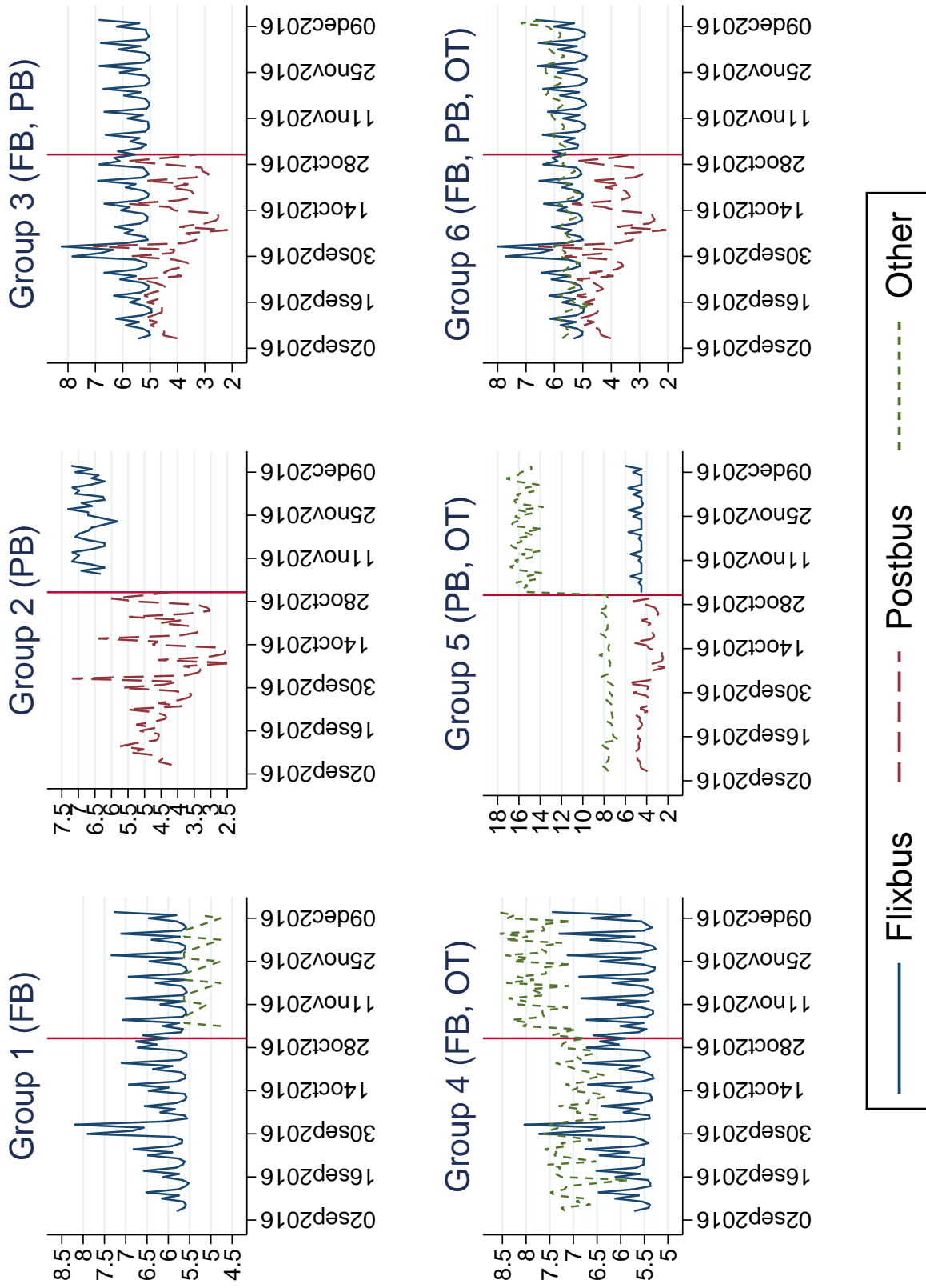


Figure 2: Price effects by group and operator in Euro cents per kilometer

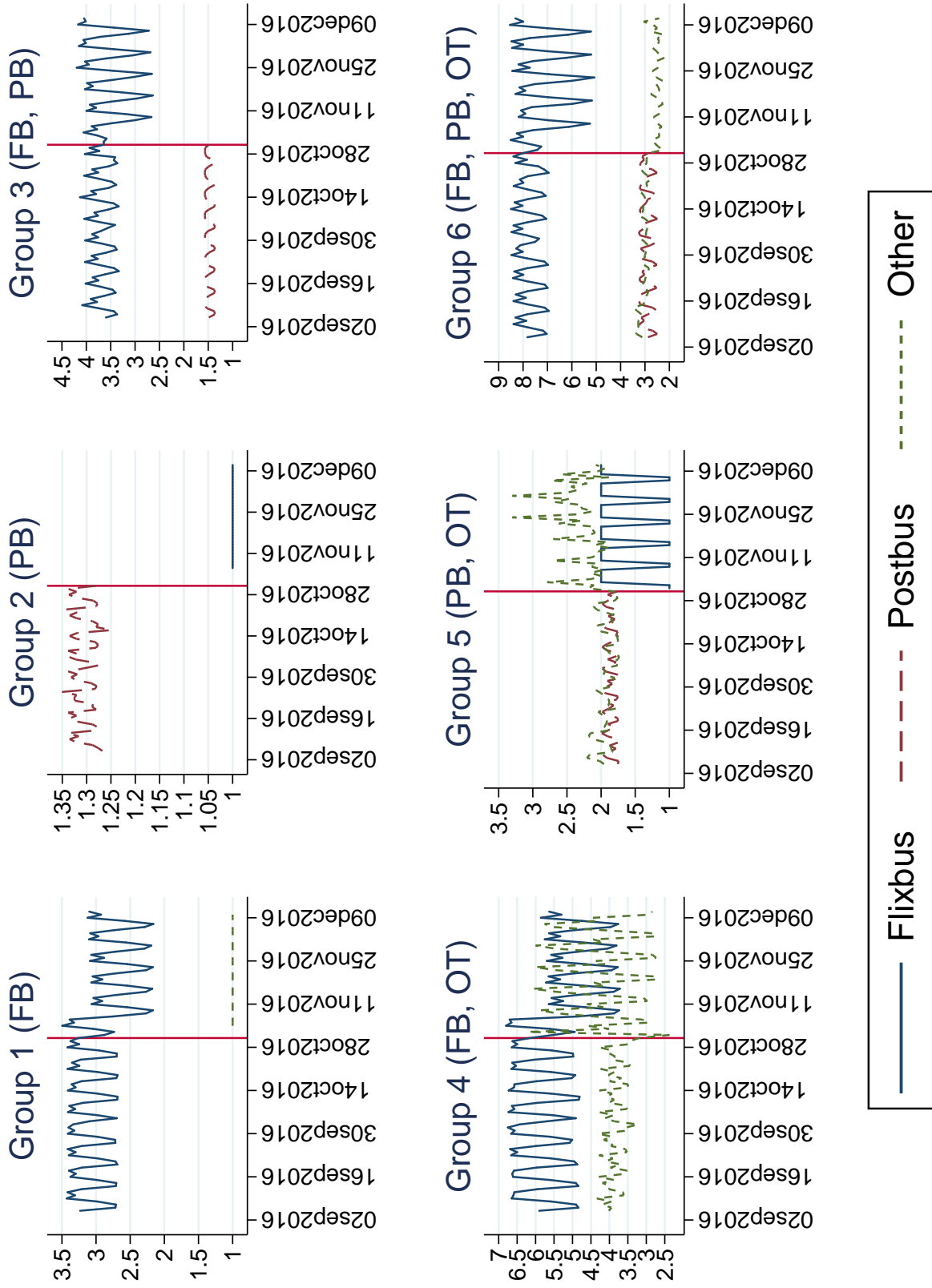


Figure 3: Number of daily trips per route by group and operator

As a robustness check we apply the regression of equation 1 with interaction terms of the dummies in matrix  $X_t$  (days of the week) and the takeover dummy  $D_{TO}$ . Table 1 shows the corresponding results, that are quite similar to the ones reported in Section 3.3.

	Coefficients	(Standard Errors)
$D_{Monday}$	0.0759***	(0.00150)
$D_{Wednesday}$	0.00214	(0.00109)
$D_{Thursday}$	0.0306***	(0.00113)
$D_{Friday}$	0.152***	(0.00187)
$D_{Saturday}$	0.0722***	(0.00136)
$D_{Sunday}$	0.176***	(0.00217)
$D_{PH}$	0.131***	(0.00138)
$D_{FB}$	-0.00974	(0.00728)
$D_{PB}$	-0.362***	(0.00819)
$D_{TO}$	0.0927***	(0.00908)
$D_{FB} * D_{TO}$	-0.0721***	(0.00898)
$D_{Monday} * D_{TO}$	-0.0733***	(0.00197)
$D_{Wednesday} * D_{TO}$	-0.0268***	(0.00160)
$D_{Thursday} * D_{TO}$	-0.0296***	(0.00170)
$D_{Friday} * D_{TO}$	-0.0402***	(0.00210)
$D_{Saturday} * D_{TO}$	-0.0540***	(0.00183)
$D_{Sunday} * D_{TO}$	0.0357***	(0.00240)
Constant	1.656***	(0.00642)
Observations	664,165	
$R^2$	0.296	

The estimation is performed by using a GMM. Dependent variable is daily average price per kilometer and is expressed in logarithm. The regression include route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for \*  $p < 0.5$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Table 1: Price determinants - Fixed effect panel regression results II



To control for a time trend, that is independent of the takeover, we furthermore apply a differences in differences approach by using share car journeys as control group. In the selection of an appropriate control group, we follow the German authority for transport that assumed share car journeys as comparable market to interurban bus services (Bundesamt für Güterverkehr, 2017). We apply this method for both, prices and daily number of trips per route. The structural equation of our model has the following form for the prices:

$$\ln p_{i,j,t} = X_t' \beta_1 + \psi_1 D_{TO,t} + \psi_2 D_{BUS,j} + \psi_3 D_{BUS,j} D_{TO,t} + \psi_4 D_{FB,j} D_{TO,t} + \psi_5 D_{PR,j} + \alpha_i + \omega_{i,j,t} \quad (1)$$

The corresponding equation for the daily number of trips per route is:

$$\ln q_{i,j,t} = X_t' \beta_1 + \chi_1 D_{TO,t} + \chi_2 D_{BUS,j} + \chi_3 D_{BUS,j} D_{TO,t} + \chi_4 D_{FB,j} D_{TO,t} + \chi_5 D_{PR,j} + \alpha_i + \sigma_{i,j,t} \quad (2)$$

The dependent variable is the logarithm of daily average prices per km or daily number of trips, respectively. Prices (number of trips) are given for each route  $i$  and provider  $j$  at day  $t$ . Whereby the provider  $j$  is either  $PB$ ,  $FB$ ,  $OT$  or  $SCJ$ . The matrix  $X_t$  includes dummies for each day of the week and a dummy variable for the public holiday and the weekend before.  $D_{TO,t}$  is a dummy variable that captures the takeover effects. We also include dummy variables,  $D_{PR,j}$ , for the providers  $PB$  and  $FB$ . The interaction term,  $D_{FB,j} * D_{TO,t}$ , determines takeover effects on prices (quantities) of  $FB$ . All time-invariant heterogeneity between different routes, is absorbed by the route fixed effects  $\alpha_i$ . Table 2 and 3, respectively, present the results of our regression. In total we have 936,101 observations.

The effects of days of the week and public holiday on average prices and daily trips per route are similar to the ones reported in Section 3.3 and 3.5. These results support the assumption that share car journeys initially experience the same trend and thus, are a appropriate control group. However, we find no (highly) significant overall effect of the takeover, neither on average prices nor on the number of daily trips. This suggests, that

	Coefficients	(Standard Errors)
$D_{Monday}$	0.0403***	(0.00109)
$D_{Wednesday}$	-0.00532***	(0.000868)
$D_{Thursday}$	0.0171***	(0.000892)
$D_{Friday}$	0.0985***	(0.00130)
$D_{Saturday}$	0.0408***	(0.00107)
$D_{Sunday}$	0.132***	(0.00156)
$D_{PH}$	0.0973***	(0.00104)
$D_{TO}$	-0.00210*	(0.000919)
$D_{BUS}$	0.0688***	(0.00754)
$D_{BUS} * D_{TO}$	0.0759***	(0.00970)
$D_{FB} * D_{TO}$	-0.0814***	(0.00974)
$D_{PB}$	-0.357***	(0.00800)
$D_{FB}$	-0.00805	(0.00732)
Constant	1.605***	(0.00225)
Observations	936,101	
$R^2$	0.214	

The estimation is performed by using a GMM. Dependent variable is daily average price per kilometer and is expressed in logarithm. The regression includes route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for \*  $p < 0.5$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Table 2: Price determinants - Difference in difference regression results

there is no time trend which is independent of the takeover, as such a trend should also effect the control group.

While PB offered low prices (about 36% below the overall average), prices for interurban bus services are on average about 7% higher than prices for share car journeys. After the takeover the average bus prices was increasing about 8%. However, as discussed above it seems not the case that FB increase its prices.

While the number of daily trips per route offered by FB is on average about 65% higher than the overall average, PB offered significantly less trips per day (about 11% less as the

	Coefficients	(Standard Errors)
$D_{Monday}$	0.158***	(0.00335)
$D_{Wednesday}$	-0.0315***	(0.00224)
$D_{Thursday}$	0.112***	(0.00333)
$D_{Friday}$	0.327***	(0.00417)
$D_{Saturday}$	0.134***	(0.00345)
$D_{Sunday}$	0.364***	(0.00423)
$D_{PH}$	0.0449***	(0.00152)
$D_{TO}$	0.00363	(0.00286)
$D_{BUS}$	-0.348***	(0.0187)
$D_{BUS} * D_{TO}$	-0.384***	(0.0242)
$D_{FB} * D_{TO}$	0.290***	(0.0243)
$D_{PB}$	-0.112***	(0.0201)
$D_{FB}$	0.653***	(0.0203)
Constant	0.659***	(0.00876)
Observations	936,101	
$R^2$	0.184	

The estimation is performed by using a GMM. Dependent variable is daily average frequency of trips per route and provider is expressed in logarithms. The regression includes route fixed-effects. Cluster-robust standard errors (clustered on route level) are presented in parentheses. Statistics are significant for \*  $p < 0.5$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Table 3: Quantity determinants - Difference in difference regression results

overall average). The daily frequency for interurban bus trips per route dropped about 38% after the takeover. This is mainly based on the market exit of two competitors (PB and BLB). Additionally, FB offered a slightly smaller number of trips per day, as also discussed above (combining the numbers of  $D_{BUS} * D_{TO}$  and  $D_{FB} * D_{TO}$ ).