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Continuation of air-services in Berlin-Tegel and its effects on housing prices

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PRELIMINARY – PLEASE DO NOT QUOTE WITHOUT PERMISSION OF THE AUTHORS

Abstract

The airport Berlin-Brandenburg that has been built for several years now will take over all flights from the existing airports in Berlin. Four weeks before the expected opening of the airport its was delayed by several months. This delay was exogeneous for (potential) residents in the surrounding of the existing airport Berlin-Tegel. We analyze the effect of airport noise and proximity to the airport on housing prices. Our identification strategy is based on the expectations regarding the termination of the airport. The results suggest that there is a negative effect of noise on housing prices while there are positive effects of proximity to Berlin-Tegel.

Keywords: Real Estate Prices, Airports, Aviation Noise, Proximity, Germany

JEL-CODES: R3, R4

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Introduction

Housing prices are determined by the characteristics of the apartment or house but also by the amenities and disamenities of the respective neighborhood. Noise and especially aviation noise is one of the disamenities that can influence house prices. Noise is a major concern in developed countries since it seems to be negatively correlated to health outcomes and can reduce the quality of life. The number of flights and passengers has been steadily increasing in Germany. The number of passengers increased from about 144 thousand in 2000 to 235 thousand in 2017⁴.

More flights can also result in more aviation noise for residents living closely to airports. If noise is related to a negative impact on life quality and health, there should be effects on housing prices since the demand for properties polluted by noise should decrease. There is a large literature on the effects of airport noise on housing prices. Baranzini and Ramirez (2005) and Andersson et al (2010) show that there are negative effects of noise pollution. The meta study of Nelson (2004) shows that there is consensus of negative effects on housing prices.

Besides the noise pollution, proximity to airports can have positive effects on house prices. Airports generate a large labor demand and provide air transportation services. Brueckner (2003) observes positive employment effects of increased airline traffic. Tomkins et al. (1998) and McMillen (2004), show that there are positive effects of the proximity to airports on housing prices. Therefore, proximity of airports and aviation noise have to be considered jointly. This were addressed by Espey and Lopez (2000), Limpscomb(2003) and Cohen and Coughlin (2008, 2009) and Ahlfeldt and Maennig (2010).

At the moment, Berlin has two airports in charge. It used to be four airports until 1994. Right after reunification there were plans for only one airport in Berlin. There were several years of planning and searching for the proper location. Finally, a decision for the airport Schoenefeld (and its surroundings) was made in 2004. A new airport Berlin-Brandenburg, BER) have been built that covers part of Schoenefeld airport and takes over all flights from and to Schoenefeld and Tegel after its opening.

The building of the airport started on September 5th 2006. The first opening date was announced to November 2011. First, there was a short delay of the opening date until June 2012. In the begging of May 2012 it seemed to be opened on this date. There were contracts with firms providing services at BER, all tickets were assigned to this airport, the opening party was planned and at Berlin-Tegel as well as the old Berlin-Schoenefeld employees and employers, residents of the neighborhood, shop owners etc. they all expected that there will be no flights in a few months. However, it came different and the opening was rescheduled to March 2013. The opening was rescheduled several times again. By now the planned opening date is October 2020.

We analyze the effects of aviation noise and proximity of the airport in the surrounding of Berlin-Tegel. We assume that the shift right before the planned opening of the new airport was exogenous to all players – landlords, sellers, renters and buyers. We therefore analyze the effect of the expected change in noise and proximity of the airport. There are already papers that analyze the effects of announcements on housing prices (Jud and Winkler, 2006 and Mense and Kholodilin, 2014). In contrast to these papers we do not analyze the effects of an expansion/opening but of the termination of an airport.

The remainder of the paper is structured as follows. First, we present the data sets we combine for the analysis. In the third section the estimation strategy is displayed. First results are reported in section 4 while section 5 concludes.

⁴ <https://www.deutschlandin zahlen.de/tab/deutschland/infrastruktur/verkehr-und-transport/luftverkehr>

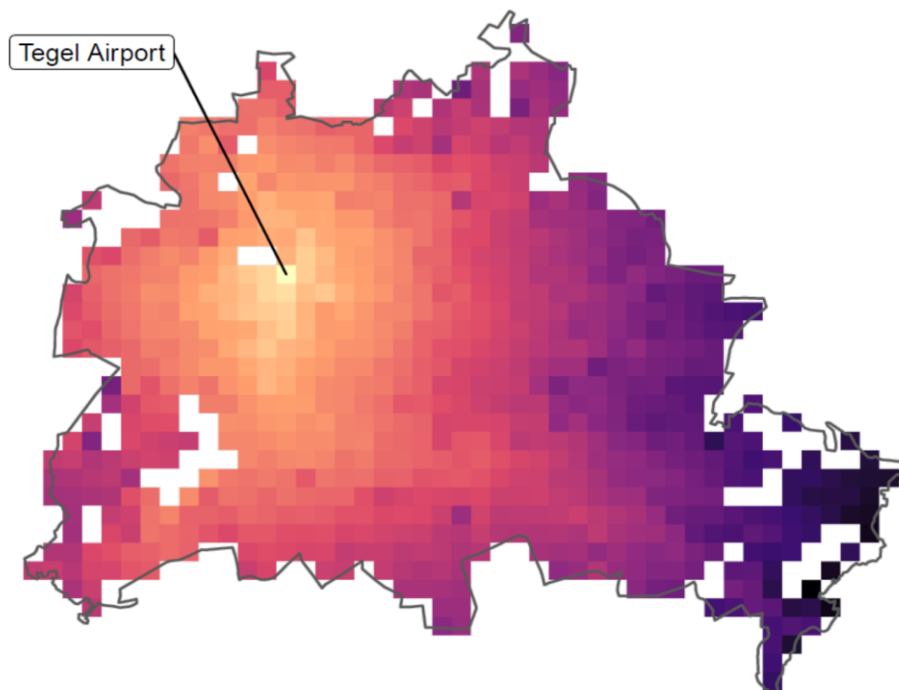
Data

For the analysis of the delayed opening of airport BER on the surroundings of the existing airport Berlin-Tegel we need different data sources: Data on housing prices, data on the distance to the airport, data on noise pollution as well as some background characteristics of the neighborhoods.

The data on housing prices is taken from **the RWI GEO-RED** data. This data is provided by the FDZ Ruhr at RWI. It covers all private advertisements for sale and for rent throughout Germany between 2007 and October 2017 on the real estate platform ImmobilienScout24. ImmobilienScout24 is the biggest real estate online platform in Germany⁵. There are four different types of advertisements: houses for sale, apartments for sale, houses for rent and apartments for rent. The data for all four types of advertisements cover characteristics like size (plot size and number of rooms), year of construction, floor, balcony, guest toilet etc. Further, there exist geo-coded address information. Unfortunately, for the first years the address was not mandatory. Therefore, not all advertisements have a proper address. From 2016 on all ads are geocoded. The addresses are assigned to 1x1km cells (EU INSPIRE regulation). A detailed description of the data can be found in Boelmann and Schaffner (2018). We take the data from 2010 to 2017 for the analysis. Besides characteristics of the apartments and houses there is also the price included that the seller or landlord requests.

We estimate the driving time to Berlin-Tegel to account for the proximity of the airport. This driving time is calculated from the center of each 1x1km cell to the airport. The driving time is calculated by the FDZ Ruhr at RWI (**RWI GEO-GRID DRIVETIME**) and is based on OpenStreetMap. Further, we implement the travel time by public transport. For this purpose, the transportation time for apartment/house is taken from the Berlin public transport provider www.bvg.de. It is the shortest travelling time between 9 and 9.30 am departure.

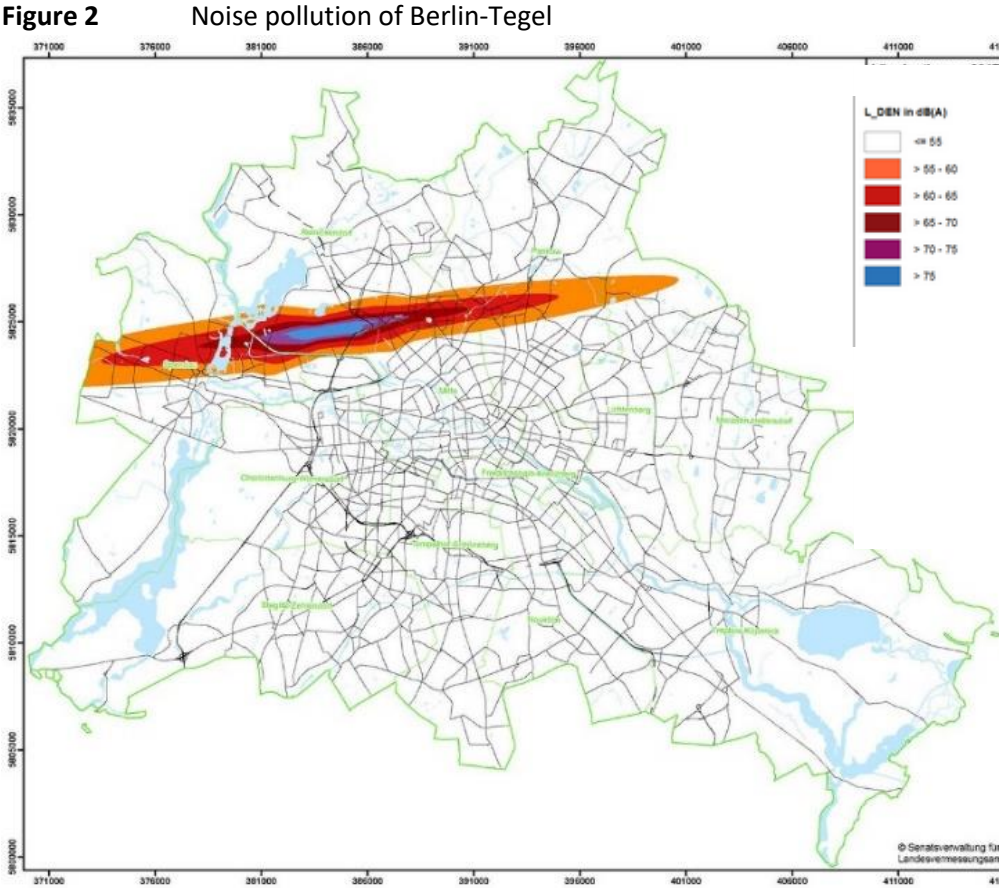
Figure 1 Drivetime to airport Tegel by 1x1km cell in Berlin



Source: Own calculation based on RWI-GEO-DRIVETIME

⁵ ImmobilienScout24 claims to represent 86% of all published advertisements.

The noise data for aviation noise are taken from Senatsverwaltung für Umwelt, Verkehr und Klimaschutz in Berlin. Their webpage provides noise maps for every type of noise separately. Therefore, aviation noise can be separately collected. The noise pollution of 55dB and more are displayed in Figure 2 for all aviation noise due to Berlin-Tegel.



Source: http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/din_705.htm

Finally, the data is enhanced by neighborhood characteristics taken from the **RWI-GEO-GRID** data. The RWI-GEO-GRID data covers socio-economic information of the residents for all populated 1x1km cells in Germany. The cells are the same as in the RWI-GEO-RED data. The RWI-GEO-GRID data comprises data on population as well as by gender and age group, purchasing power, credit default risk classes, cars and migration background of the residents. The data are described in Breidenbach and Eilers (2018). We apply v7 of the data covering the years 2005 and 2009-2016 (RWI/microm 2018a,b).

Estimation Strategy

The estimation strategy depends on the announcements made regarding the opening of the airport Berlin-Brandenburg (BER) (and therefore further operating of Berlin-Tegel) and on the neighborhood of Berlin-Tegel.

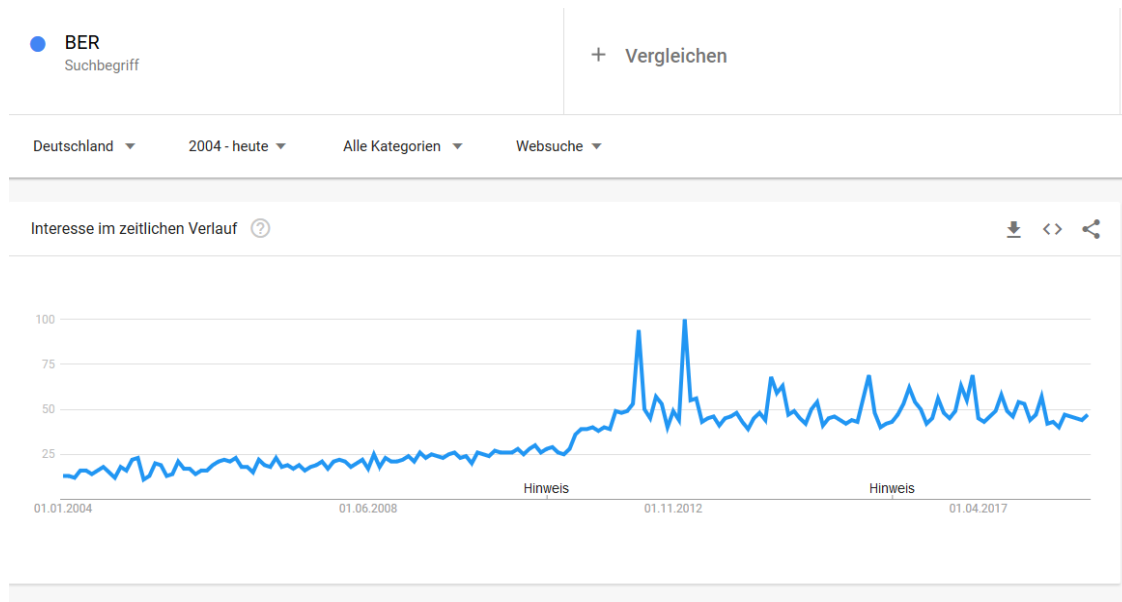
Table 1 gives an overview of the announcements regarding the opening of BER. The first planned opening date was the end of October 2011. In mid-2010 this data was shifted to Jun 3rd 2012. Until May 2012 there were no signs for public that it was not opening the next months. Therefore, also those looking for housing in the neighborhood of Berlin-Tegel expected that the airport was closing within the next weeks. On May, 8th 2012, almost 4 weeks before the planned opening was shifted by more than 8 months. In September 2012 it was already shifted additional seven months later. During this time period the faith of the public in a quick opening vanished since mismanagement and constructional defects had become public. The opening was shifted again and is now expected for October 2020.

Table 1 Opening dates for airport Berlin-Brandenburg (BER)

Announcement date	Planned Opening	Declared New Opening
Sep 2006		Oct 30 th 2011
Jun 2010	Okt 30 th 2011	Jun 3 rd 2012
May 2012	Jun 03 rd 2012	Mar 17 th 2013
Sep 2012	Mar 17 th 2013	Okt 27 th 2013
Jan 2013	Okt 27th 2013	not declared
Dez 2014	not declared	2nd half of 2017
Jan 2017	2nd half of 2017	2018
Dez 2017	2018	Oct 2020

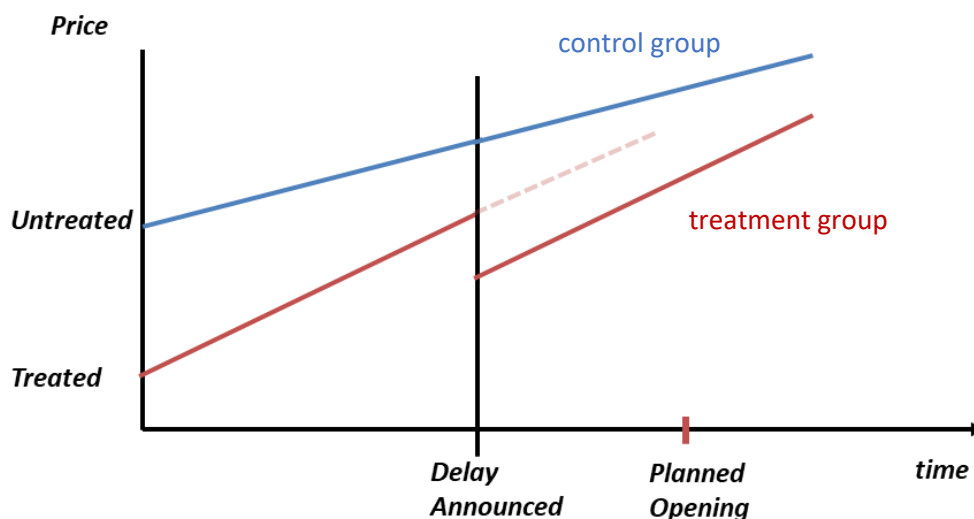
We assume that the delay of the opening was an exogeneous shock for all renters, landlords, sellers and potential buyers. Tickets for a flight after the opening were all signed to the new airport. There were no signs that the opening will be shifted and that there is no termination of Berlin-Tegel. Before the beginning of May, newspaper articles were about the opening and the corresponding ceremonies. Still, it was not a big subject in German media outside of Berlin and Brandenburg. This changed when the delay was declared four weeks before the planned opening. The change in public interest can also be seen in Google Trends. Figure 3 displays the number of searches for the subject "BER" over time. It can be seen that increased when the first announcement was made. Further, there were huge increases when more skepticism regarding the construction were spread in media the following months.

Figure 3 Google trends summary for “BER”



We assume that (potential) renters and buyers of apartments and houses expect that the airport closes a few weeks after the opening of BER. Therefore, for housing affected by aviation noise they take into account that the noise is going to vanish soon. Therefore, we assume that rents are lower than in regions without noise but converges to the overall development (in Berlin). Housing prices in Berlin have been increasing. Figure 4 shows the expected time development priced of the treated (by aviation noise) apartments and the non-treated apartments. The converging process can be observed. However, when the appointment was made there is a shift again since they expect a longer time period until the noise is going to vanish.

Figure 4 Expected price development by noise treatment



First, we apply a difference-in-differences approach with group specific time trends:

$$y_{ignt} = \alpha_1 N_n + \alpha_2 T_t + X_i \beta_1 + Z_g \beta_2 + \gamma_1 trend_t + \gamma_2 trend_{nt} + \delta Treat_{nt} + u_{ignt} \quad (1)$$

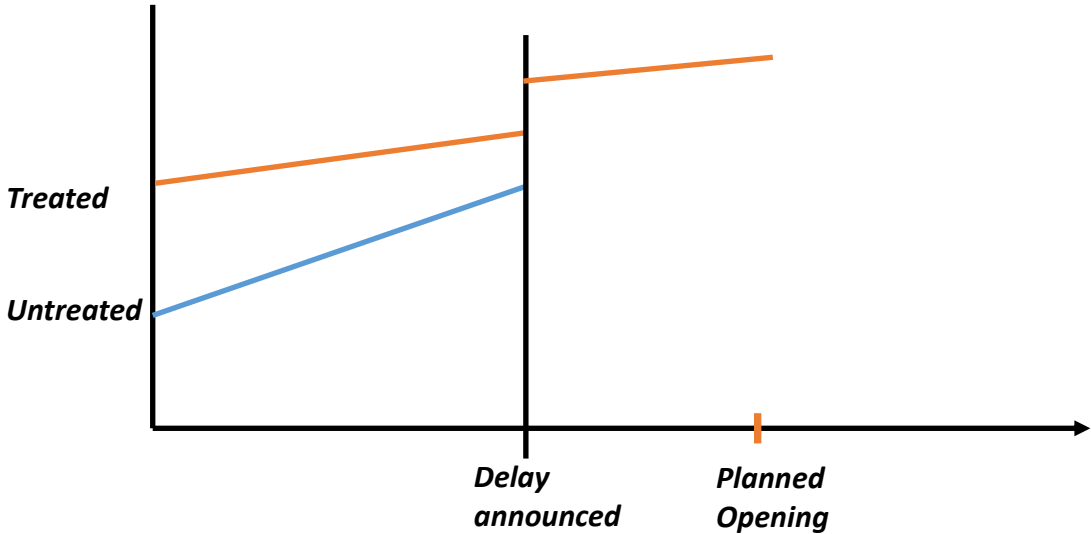
With y_{igt} being the price per square meter (log), N_n is a dummy for noise-polluted objects, T_t takes the value 1 if the object was inserted after January 2013 and 0 otherwise. Characteristics of the object are covered in X_i and characteristics of the 1x1km cell (no. of HH, no. of inhabitants, purchase power, drivetime to Tegel) in Z_g : Grid-Characteristics. The time trends are defined as an monthly overall linear time trend $trend_t$ and an additional monthly time-trend for all noise-polluted objects. Finally, $Treat_{nt}$ ($N_n * T_t$) is the difference-in-differences dummy that takes the value 1 for noise-polluted objects after the announcement and zero otherwise.

Regarding the proximity effects of the airport a similar approach is driven with the objects within a certain driving time as treatment group and all other parts of Berlin as control group. The difference-in differences estimation is defined similarly to equation (1):

$$y_{igt} = \alpha_1 N_d + \alpha_2 T_t + X_i \beta_1 + Z_i \beta_2 + \gamma_1 trend_t + \gamma_2 trend_{dt} + \delta Treat_{dt} + u_{idt} \quad (2)$$

By contrast to the noise pollution it is now assumed that the housing prices within the treatment group (high proximity to airport) are higher due to the amenities like jobs and transportation services. However, prices converge from above. The amenities disappear when the airport is closed. This development is displayed in Figure 5. Due to the announcement the expectations changes to more utility in the preceding months prices should go up at the point of announcement while the converging process starts again afterwards.

Figure 5 Expected price development by proximity treatment



Additionally to this difference-in-differences approach, we also apply a regression discontinuity design as well as a event study approach....

First results

First, we estimate eq. (1) for noise pollution on apartment rents. We restrict the analysis to all observations that are within a driving time of 15 minutes. Within this area the treatment group consists of all apartments that suffer from aviation noise of at least 55dB, 65dB and 70 dB, respectively. The control group are all apartments that experience less than 55dB of aviation noise. The results presented in Table 2 suggest that there is a positive time trend for all apartments as expected (nominal prices in Berlin), furthermore, the time trend in the treatment group is even higher. Additionally, the apartments treated with noise have lower prices. These two findings indicate that there is a converging process as expected. The difference-in-differences operator (post-treatment x noise) is negative suggesting that there is a negative effect due to the anticipation of further noise pollution in the future. The results are stable for the three different noise thresholds chosen.

Table 2: Rent-Effects of Noise pollution (day-noise)

Dep. Variable: ln(Price per sqm)	Noise-Threshold ...		
	55 db	65 db	70 db
Monthly Trend	0.0045*** (0.000)	0.0045*** (0.000)	0.0046*** (0.000)
Monthly Trend x Noise	0.0009** (0.000)	0.0008* (0.000)	0.0042** (0.001)
Noise-Dummy	-0.6141*** (0.245)	-0.5886** (0.282)	-2.7377*** (0.543)
Post-Treatment (January 2013)	0.0209*** (0.006)	0.0203*** (0.006)	0.0188*** (0.006)
Post-Treatment x Noise	-0.0396*** (0.009)	-0.0352*** (0.009)	-0.1225*** (0.022)
Additional controls on observation & grid-level	x	x	x
Total No. of Obs.	162088	136505	132408
No. of treated Obs. (pre)	19457	2783	277
No. of treated Obs. (post)	10640	1731	140

Note: Standard errors in parentheses. Standard errors are clustered on the 1x1km level; ***, **, * denote significance at the 1 %- 5 %- and 10 %-level.

Table 3: Rent-Effects of Proximity

Dep. Variable: ln(Price per sqm)	Treated when below x Minutes to Tegel		
	X=10	X=15	X=20
Monthly Trend	0.00467*** (0.000)	0.00479*** (0.000)	0.00505*** (0.000)
Monthly Trend x Drive-Dummy	-0.00110*** (0.000)	-0.00061* (0.000)	-0.00098* (0.000)
Drive-Dummy	0.70242*** (0.191)	0.39784* (0.220)	0.64608*** (0.165)
Post-Treatment (January 2013)	0.0056 (0.007)	-0.0024 (0.007)	-0.0103 (0.009)
Post-Treatment x Drive-Dummy	0.03695*** (0.012)	0.04391*** (0.013)	0.04099*** (0.011)
Additional controls on observation- & grid-level			
Total No. of Obs.	788939	788939	788939
No. of treated Obs. (pre)	9878	64422	135228
No. of treated Obs. (post)	9596	67569	141270

Note: Standard errors in parentheses. Standard errors are clustered on the 1x1km level; ***, **, * denote significance at the 1 %- 5 %- and 10 %-level.

Table 4: Rent-Effects of Noise pollution (Level & Trend)

Dep. Variable: ln(Price per sqm)	Noise-Threshold ...		
	55 db	65 db	70 db
Monthly Trend	-0.004 (0.008)	-0.004 (0.004)	-0.003 (0.005)
Drivetime2Tegel (in seconds)	-0.023*** (0.002)	0.004*** (0.001)	0.002 (0.002)
Noise (column header)		-0.160*** (0.008)	-0.149*** (0.009)
Monthly Trend x Noise		0.092*** (0.017)	0.054** (0.022)
Post-Treatment (January 2013)			0.084*** (0.026)
Post-Treatment x Noise			-0.000 (0.001)
Monthly Trend x Noise x Post-Treatment			
Controls on observation- & grid-level	0.042*** (0.002)	0.261*** (0.076)	-0.035 (0.105)
Total No. of Obs.	271	271	271
No. of treated Obs. (pre)			
No. of treated Obs. (post)	4352	4352	4288

Note: ***, **, * denote significance at the 1 %- 5 %- and 10 %-level.

Table 5: Sales-Effects of Noise pollution (day-noise)

Dep. Variable: ln(Price per sqm)	Noise-Threshold ...		
	55 db	65 db	70 db
Monthly Trend	-0.004 (0.008)	-0.004 (0.004)	-0.003 (0.005)
Drivetime2Tegel (in seconds)	-0.023*** (0.002)	0.004*** (0.001)	0.002 (0.002)
Noise (column header)		-0.160*** (0.008)	-0.149*** (0.009)
Monthly Trend x Noise		0.092*** (0.017)	0.054** (0.022)
Post-Treatment (January 2013)			0.084*** (0.026)
Post-Treatment x Noise			-0.000 (0.001)
Controls on observation- & grid-level	0.042*** (0.002)	0.261*** (0.076)	-0.035 (0.105)
Total No. of Obs.	271	271	271
No. of treated Obs. (pre)			
No. of treated Obs. (post)	4352	4352	4288

Note: ***, **, * denote significance at the 1 %- 5 %- and 10 %-level.

Further approaches – not documented yet

Regression discontinuity design

event study

Robustness checks

Non-linear time trends

Measuring proximity by different distances (10 minutes, 20 minutes, 25 minutes)...

Measuring proximity by travelling time through public transport (not implemented yet)

Conclusion

- Exogenous & unanticipated shock via noise and connectivity within densely populated area
- Noise reduces rent-price development by about 4 to 5%
 - Up to 12% for high noise pollution (critical no. of observation)
- Connectivity increases rent-price development by about 4%
- Effects robust to different delay-announcements (May 2012)
- Effects robust to different identification strategy
 - Shift-effects vs. Trend-adjustments (*not presented*)
- No robust effects for sale-prices
 - In line with expected “short planning horizon”

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