GERMAN COUNCIL
of Economic Experts

Heterogeneous price and quantity effects of the real estate transfer tax in Germany

Désirée I. Christofzik[*)]
(Federal University of Applied Administrative Sciences & University of Siegen)
Lars P. Feld[**)]
(University of Freiburg, Walter Eucken Institute & German Council of Economic Experts)
Mustafa Yeter[***)]
(German Council of Economic Experts & University of Goettingen)

Working Paper 10/2020[****)]
December 2020

*) Federal University of Applied Administrative Sciences & University of Siegen, E-Mail: desiree.christofzik@hsbund.de.

**) University of Freiburg, Walter Eucken Institute & German Council of Economic Experts, E-Mail: feld@eucken.de.

***) German Council of Economic Experts & University of Goettingen, E-Mail: mustafa.yeter@svr-wirtschaft.de.

Heterogeneous price and quantity effects of the real estate transfer tax in Germany

Désirée I. Christofzik[1] Lars P. Feld[2] Mustafa Yeter[3]

December 15, 2020

Abstract

Using quarterly data for German counties, we study how housing prices and offers respond to higher transaction costs induced by tax increases. Since 2006, states can set their own tax rates on real estate transfers. Several and substantial tax hikes generate variation across time and states which we exploit in our empirical analysis using an event study design. Our results indicate that prices and offers decrease significantly by 3% and 6% already in the quarter in which the tax increase is announced in press but rise subsequently. Furthermore, we find heterogeneous responses when distinguishing between different types of counties. Housing prices decrease persistently in shrinking counties, while this is at most temporarily the case in growing, central and peripheral counties. This implies that the economic incidence of this tax varies across transactions.

JEL classification: H20; H22; H71; R32; R38

Keywords: Real estate transfer tax; real estate prices; housing market; tax incidence; anticipation effects

Acknowledgments: This article reflects the personal views of the authors and not necessarily those of the German Council of Economic Experts. We are grateful to the Research Data Center Ruhr at the RWI for providing data on house prices. We would like to thank Thiess Buettner and Sebastian Siegloch for valuable comments. Moritz Schubert and Marco Wysietzki provided excellent research assistance.

[1]Federal University of Applied Administrative Sciences and University of Siegen,
e-mail: desiree.christofzik@hsbund.de

[2]University of Freiburg, Walter Eucken Institute and German Council of Economic Experts,
e-mail: feld@eucken.de

[3]German Council of Economic Experts and University of Goettingen,
e-mail: mustafa.yeter@svr-wirtschaft.de

1 Introduction

An important dimension of fiscal federalism is the degree to which revenue autonomy is granted to subnational authorities. This characteristic may have direct repercussions on potential efficiency gains from fiscal federalism (e.g., Janeba and Wilson, 2011). Besides the optimal degree of fiscal federalism, the suitability of the tax instrument used to grant revenue autonomy is of utmost importance. This does not only apply to the respective properties of individual tax types but also to their interaction with other elements of fiscal federalism such as fiscal equalisation schemes.

In Germany, discretion over the tax rates of only one tax is granted to the state level: the real estate transfer tax (RETT). It is levied on the total sales price of a property in the case of real estate purchases. Since a large-scale constitutional reform of the system of fiscal federalism in 2006, states have the right to determine their own tax rate, while the tax base continues to be determined at the federal level. Revenue is allocated to full extent to the state level. Since the reform, RETT rates were raised frequently and substantially by nearly all of the 16 German states. However, those increases differ in timing and also in their extent. Buettner (2017) provides evidence that these tax hikes are likely to be associated with substantial deadweight losses. While Krause and Potrafke (2020) document a correlation between the political ideology of state-level governments and the observed pattern of tax hikes in the RETT, Buettner and Krause (2020) emphasise the adverse incentives stemming from the fiscal equalisation scheme in Germany.

The turnover rate for houses and apartments in Germany is relatively low. One explanation for this observation is high transaction costs (Kaas et al., 2020). The RETT accounts for a large share in the incidental costs of real estate purchases. It may reduce the frequency of real estate transactions and induce lock-in effects. This can, for instance, generate misallocation costs, e.g., when shrinking households stay in too large houses, and vice versa (Hilber and Lyytikäinen, 2017; Lundborg and Skedinger, 1999). Alternatively, the RETT can alter the timing of purchases, hereby inducing welfare losses. For Germany, Fritzsche and Vandrei (2019) provide evidence for lock-in effects as well as anticipatory effects with respect to the RETT. Petkova and Weichenrieder (2017) document heterogeneous effects with respect to different types of real estate.

Most empirical studies investigating the effects of transfer taxes on property markets in other countries find that through price adjustments a large part of the tax burden is borne by the seller. This is shown, for example, by studies for the Australian real estate market (Davidoff and Leigh, 2013), for houses and apartments in New York and New Jersey (Kopczuk and Munroe, 2015), for the United Kingdom (Best and Kleven, 2018; Besley et al., 2014), for Toronto (Dachis et al., 2011), and for Florida (Ihlanfeldt and Shaughnessy, 2004). Furthermore, there is empirical evidence for a negative effect on transactions or listings (e.g., Davidoff and Leigh, 2013; Dachis et al., 2011; Hilber and Lyytikäinen, 2017; Kopczuk and Munroe, 2015). Also anticipation effects are identified

(e.g., Slemrod et al., 2017). However, these findings are not necessarily transferable to the German case. On the one hand, most studies evaluate temporary tax changes while we exploit permanent tax changes in this study. On the other hand, some studies examine distinct local real estate markets or individual price segments. The changes of the RETT in Germany, however, affect almost all private property transactions.

A recent empirical study for Germany provides evidence that the reduction in prices following RETT hikes is larger than the respective change in the tax liability (Dolls et al., 2019). Our basic results are similar, but differ when focusing on different types of counties. In addition, we emphasise the importance of the announcement of tax increases instead of relying on the timing of the legal implementation of the tax reform. The majority of tax changes is already announced in press three quarters prior to their legal implementation. Empirical evidence shows that agents already adjust their behaviour before a tax policy measure comes into effect (Mertens and Ravn, 2011). Such fiscal foresight can distort inferences about the effects of tax policies. In our analysis, we find strong anticipatory effects for prices in reaction to the announcement. Moreover, we take into account the number of offers and find transient negative effects.

The asking price per square meter is reduced by approximately 3% already in the quarter of announcement. As a tax hike of one percentage point should result in an increase of approximately 1% in the price a buyer has to pay, our results indicate that at this point in time the reduction in the price exceeds the change in the tax burden. Using an event study design, we can show that there is also a robust persistent effect. Furthermore, the number of offered houses decreases after a tax increase is announced in the press. Offers are temporarily reduced by 6%, with heterogeneous outcomes, however, when distinguishing between different types of counties.

We differentiate between four types of counties based on classifications by the German Federal Institute for Research on Building, Urban Affairs and Spatial Development. In shrinking counties, asking prices are still negatively affected two years after the announcement and offers go down by over 8% for several quarters, indicating stronger lock-in effects. Only a temporary decrease in prices and quantities subsequent to the announcement can be identified in growing counties. In addition, we divide the universe of German counties into peripheral and central ones using a classification that also includes commuter balances to take into account labour market characteristics. In these two types of regions as well, the mean prices decrease only temporarily. While in general sellers bear the additional tax burden in these regions, effects seem to persist only in case of shrinking counties.

In the following section, we provide institutional details with respect to the RETT in Germany, the system of fiscal federalism and the data used in our empirical analysis. Section 3 describes our empirical approach while section 4 provides our main results and robustness analyses. Section 5 concludes.

2 Institutional framework and data

2.1 Institutional framework

Within the German system of fiscal federalism, revenues from only a limited number of taxes are allocated to full extent to the state level. The RETT exhibits the largest share among this group of taxes. Based on administrative tax data for 2019, the share of the RETT amounts to 61.1%. Additionally, it is the only tax where states can set their own tax rate. When considering the total tax revenue of the states including their share in revenue from joint taxes, the weight of the revenue from the RETT, however, is rather small and only corresponds to approximately 4.9%.

The RETT in Germany is designed as a flat-tax including a small exemption limit of 2,500 Euros. In general, the formal payment obligation falls to the seller. It is further designed as a transaction tax without input tax deduction. In case of repeated transactions for the same property, this tax exerts a cumulative effect as the RETT is always levied on the gross tax base and not just the value added between two transactions. Historically, decision-making power with respect to the RETT rates changed from the state to the federal level and back again with strong repercussions on the respective effective level of taxation. While initially the sovereignty to set tax rates was allocated to the state level, tax rates ranged between 6% and 7%. In response to the relatively high tax rates, in 1983, the federal level withdrew state sovereignty on the RETT rate and introduced a uniform tax rate that had to be applied by all states. This uniform tax rate was first set at 2% and later raised to 3.5%.

Following a large-scale constitutional reform of German fiscal federalism in 2006, sovereignty with respect to the RETT rate was again allocated to the state level. Since then, only two of the 16 German states, Bavaria and Saxony, refrained from raising their tax rates. All other states increased their tax rates, however, to a varying degree and in a differing number of steps (see Figure 1). In none of the states a tax cut in the RETT was implemented. Given the current distribution, the maximum tax rate is given by 6.5% and reached a level comparable to the status prior to the withdrawal of state sovereignty with respect to the RETT. This tax rate is levied on real estate transactions in five states.

The increasing tax rates of a majority of states may be partly attributed to limited means of revenue autonomy and restrictions from state-specific debt brakes which went into force in 2020.[1] However, there are also incentives stemming from the federal fiscal equalisation scheme (Buettner and Krause, 2020). Crucial for this line of argument is the fact that not actual but rather hypothetical tax revenue based on a standardised procedure using a weighted average of tax rates is used to calculate transfers within the scheme. This may result in situations where increasing the RETT rate, despite adversely affecting the tax base, may lead to increased transfers which may overcompensate the loss in the tax base. In these cases, RETT hikes are overall attractive.

[1] See Section 3.1 for further details.

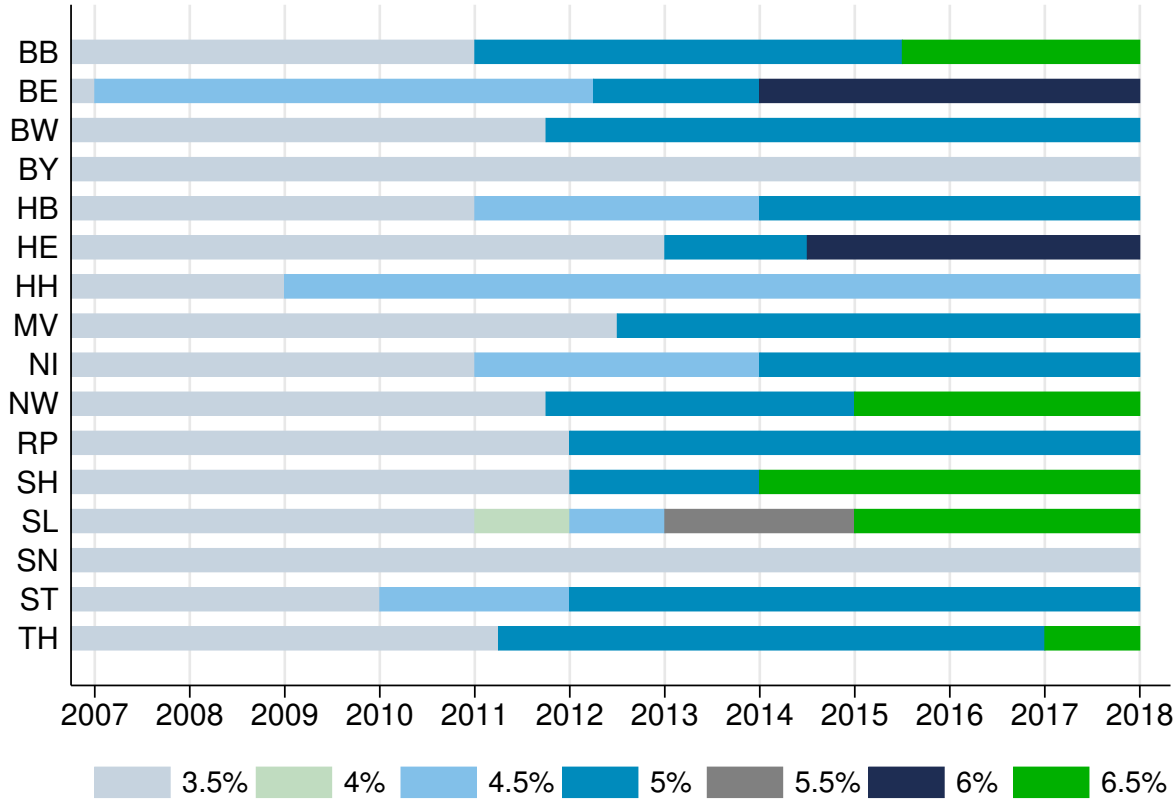


Figure 1: RETT rates in the German states (2006-2018). BB: Brandenburg, BE: Berlin, BW: Baden-Wuerttemberg, BY: Bavaria, HB: Bremen, HE: Hesse, HH: Hamburg, MV: Mecklenburg-Western Pomerania, NI: Lower Saxony, NW: North Rhine-Westphalia, RP: Rhineland-Palatinate, SH: Schleswig-Holstein, SL: Saarland, SN: Saxony, ST: Saxony-Anhalt, TH: Thuringia.

2.2 Data

Our sample consists of quarterly observations for the time period from 2007 to 2017. The main dependent variable in our empirical analysis is the logarithm of the median asking prices per square meter for houses at the county level for all 402 German counties and county-free cities. Price data is obtained from a major online real estate web site in Germany, ImmobilienScout24, and provided via the Research Data Center Ruhr at the RWI–Leibniz Institute for Economic Research. A comparison between price indices for residential real estates provided by the Deutsche Bundesbank and an aggregate index constructed by population weighted asking prices from our data set shows remarkably similar developments and weakens potential concerns due to the limitation to asking prices (see Figure A1 in the Appendix).[2] Throughout the time period covered in our sample, the average quarterly median house price per square meter increased from 1,445 Euros to 1,887 Euros in 2017.[3] The alternative dependent variable in our empirical analysis is

[2] Due to the lack of data, we cannot quantify the extent of tax evasion or avoidance that could become more attractive with tax increases (Agarwal et al., 2020).

[3] The price developments strongly differ between counties (see Figure A2 in the Appendix).

the logarithm of the number of offered houses for which information is obtained from the same data source.

In order to test for heterogeneous effects in the incidence of the RETT, we divide the universe of German counties and county-free cities along two different dimensions: namely whether they are shrinking or growing and whether they are peripheral or central. The classifications are based on data provided by the German Federal Institute for Research on Building, Urban Affairs and Spatial Development.[4]

The criteria used for the distinction between shrinking and growing counties involve a change in the population of the county, in annual net migration, in the population of working age, in employment with mandatory social security contributions, in unemployment rates and the annual revenue from local business taxes. All criteria are summarised into individual distributions ordering observations using quintiles. Points are assigned to each county based on its position in the distribution of each dimension. The final sum of points then determines the classification within the final scale. The latter consists of five categories: growing above average, growing, no clear indication, shrinking, shrinking above average. For our empirical analysis, we subsume these categories into a dichotomous dummy variable.

The classification as a central or peripheral county is based on a reachability analysis for the universe of German counties. Considering the net of commuters within a journey distance of two hours, this classification resorts to inhabitants and also takes into account regional labour market hubs. Besides the number of inhabitants, the classification as a labour market hub is likely to have repercussions on the respective regional real estate markets. The impact of commuters within the classification decreases with distance and is set up comparable to a gravity model. Based on the resulting distribution, counties are classified along four categories: highly peripheral, peripheral, central, highly central. For our empirical analysis, we again subsume these categories into a dichotomous dummy variable.

We also account for further characteristics of the real estate market at the county level. For instance, we control for the level of asking rent prices per square meter in each county. These are captured via an index with categories starting from below four Euros per square meter with one Euro steps up to the category of 17 Euros and above. Additionally, we control for the number of building permits per 1,000 inhabitants and the county-specific availability of recently finished real estates. Both variables are provided by the statistical offices of the states and the federal level. In order to account for the purchasing power of potential buyers and local business cycle shocks, we control for the level of disposable household income per capita at the county level.[5]

Throughout the time period under consideration, several changes in the structure of counties occurred in nine out of 16 states. These involved mergers, splits, enlargements

[4] The regional distributions in case of both dimensions are depicted in Figure A3 in the Appendix.

[5] As quarterly data is not available for these variables, we extend annual data to quarterly observations.

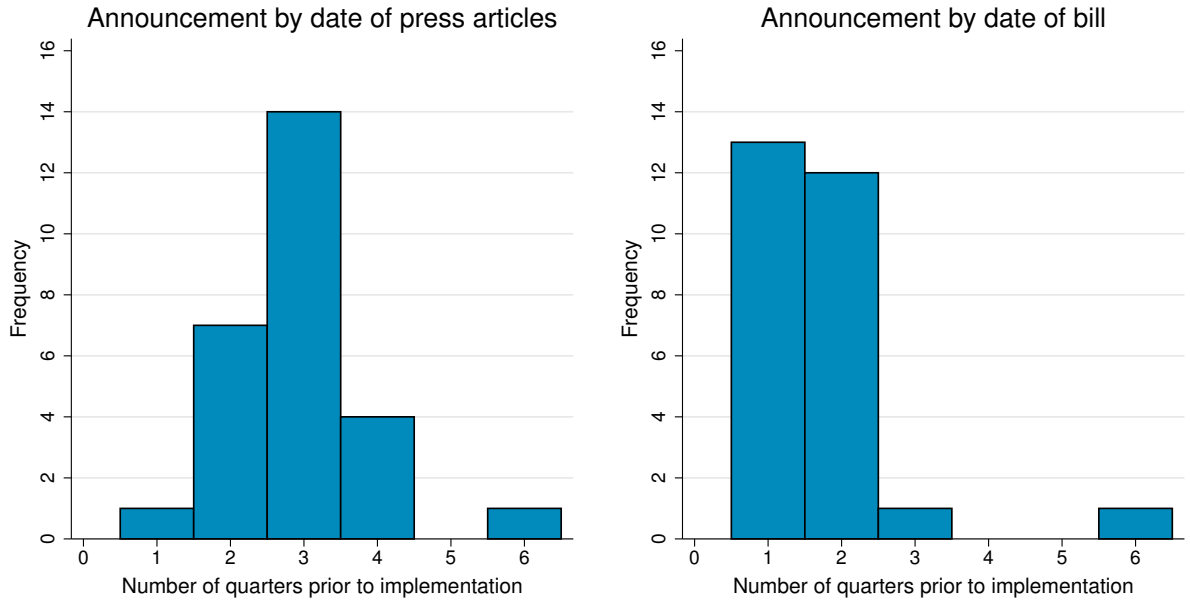


Figure 2: Announcement of tax increases. The left histogram depicts the lag between the announcement in press and the legal implementation, the right hand panel shows the lag between the draft of the law and the implementation.

and reductions. We account for all these changes by retracing and recalculating values in our data set, where necessary, to match the change in the number and structure of respective counties through time. We further capture these county mergers and splits in a dummy variable and test for the robustness of our empirical results by excluding the respective counties.

Data on changes of state-specific RETT rates is obtained from the German Working Party on Tax Revenue Estimates *(Arbeitskreis Steuerschätzungen)*. Additionally, we collected information on the date of the legal draft as well as the date of the first announcement of the tax change in major newspapers. We conducted our search for relevant newspaper articles using the Genios database, which is a commercial aggregator service including German daily and weekly newspapers. The uniform search key corresponded to '*real estate transfer tax (name of the respective state)*'. The selection of relevant articles was further limited to the major regional and nation-wide newspapers as well as press agencies in order to ensure a sufficient public dissemination of the respective information.[6] As depicted in Figure 2, most tax increases were already foreseeable up to three quarters prior to their implementation. The legal draft of the tax changes, in contrast, was only published one to two quarters prior to the implementation. In our baseline event study estimations, we rely on the press announcement dates as the relevant events.

[6] Table A2 in the Appendix summarises our search results and their respective sources.

3 Econometric framework

3.1 Identification

To study the effect of the RETT on house prices and offers, we exploit a reform which was implemented in 2006 and allowed the German states to set their own tax rates independently. Except for two, the remaining 14 states increased their tax rates several times by differing amounts and at different points in time (see Section 2.1). This provides us with variation across time as well as between states on which we rely in our empirical analysis.

In order to identify the effects of the tax rate changes on real estate prices and offers, it is necessary that confounding variation potentially driving both - the changes in prices and offers as well as in the RETT rates - can be excluded convincingly. Crucial against this background is the fact that while discretion on setting the RETT rate rests on state governments, real estate prices and offers on which we rely in our empirical analysis are aggregated at the lower county level (see Section 2.2). This allows us to contrast price developments and alterations in offers in counties where house sellers and buyers have been confronted with tax hikes to those where no changes in the RETT occurred. Furthermore, this permits us to contrast developments in different types of counties.

Despite this setup, the possibility may not be excluded that changes in the RETT are motivated by county-specific economic conditions which in turn may also influence local real estate prices. Therefore, we formally check for such potential relationships within an event study setup by testing for patterns in variables that are associated with local shocks to the business cycle or on the housing market. As left-hand-side variables, we include disposable income per capita, building permits per 1,000 inhabitants as well as the average asking rents per square meter, respectively. In an event study setup using the time pattern of press announcements of changes in the RETT, our results indicate flat pre-trends. There seem to be virtually no repercussions on these variables also subsequent to the announcement of RETT changes. These findings suggest that there is no direct link between county-specific characteristics and changes in the RETT rate (see Figure A4 in the Appendix). This supports our identifying assumption.

Further support for the identifying assumptions stems from the justifications for tax hikes made by state governments as published in their legal drafts. These justifications usually refer to the need for an increase in tax revenue in the long-run rather than current fiscal needs. This long-run instead of short-run perspective is usually motivated by the transition period for the debt brake at the state level which was decided upon in 2009 but went into force only in 2020. In sum, all these aspects support the causal interpretation of our estimates.

3.2 Event study

In order to study the dynamics of the changes in house prices and offers prior and subsequent to press announcements of RETT hikes, we implement an event study design. As the institutional setting and observed RETT changes involve multiple events with different treatment intensities, we employ event studies exploiting the multiplicity, sign and intensity of the treatment. Our baseline event window runs from four quarters prior to the press announcement to eight quarters subsequent to it.[7] Given the finite number of leads and lags in the definition of our event window, we bin its endpoints (Schmidheiny and Siegloch, 2019). The treatment indicator in the quarter prior to the event is normalised and set to zero.

We estimate event study specifications of the following form for the logarithm of the median house price per square meter and the number of offers $ln(y)_{i,t}$ located in county i which is part of state j and administrative district l, and quarter t:

$$ln(y)_{i,t} = \sum_{k=\underline{k}}^{\bar{k}} \beta_k b_{j,t}^k + \mu_i + \theta_{l,t} + \gamma_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where $b_{j,t}^k$ refers to the corresponding leads and lags of the treatment indicator, and μ_i to county fixed effects. We further account for regional shocks non-parametrically by interacting quarter fixed effects with dummies for administrative districts ($\theta_{l,t}$).[8] In our baseline specification, we include two binary variables $\gamma_{i,t}$ that take the value of 1 in case of the state of Thuringia in the fourth quarter of 2009 and the first quarter of 2010, respectively, to account for a one-off effect that involves an increase in offers by up to 400% during a single quarter.[9] $b_{j,t}^k$ is further specified as:

$$b_{j,t}^k = \begin{cases} \sum_{s=t-\underline{k}}^{\bar{t}-\underline{k}-1} d_{j,s} & \text{if} \quad k = \underline{k} \\ d_{j,t-k} & \text{if} \quad \underline{k} < k < \bar{k} \\ \sum_{s=\underline{t}-\bar{k}+1}^{t-\bar{k}} d_{j,s} & \text{if} \quad k = \bar{k} \end{cases} \tag{2}$$

Additionally, we test for heterogeneous effects conditional on different county types. To study whether price reactions and alterations in offers vary between types of counties, we estimate Equation (1) separately for shrinking and growing as well as peripheral and central counties.

---

7 In robustness checks, we alter the size of the event window.

8 For states where this additional layer between counties and states does not exist, we include quarter fixed effects.

9 Specifications in which we include county-specific control variables (the logarithms of asking rents per square meter, the number of building permits and households' disposable income per capita) yield similar results.

4 Results

4.1 Main results

In our baseline event study, we first test for price effects using the median property log asking price per square meter at the county level as dependent variable. The left panel of Figure 3 depicts the results without indication of a statistically significant trend prior to the treatment. Following the announcement of a one percentage point tax increase in the press, the asking price per square meter is reduced contemporaneously by approximately 3%. This negative anticipation effect can be explained by the relatively long time horizon that is necessary to complete a house purchase. Most tax changes are announced two or three quarters prior to their implementation, see Figure 2. Against this background, the increased tax burden is likely to be levied on most houses that are offered after the announcement. In the following quarters, prices increase slightly rendering the effect no longer statistically different from zero. One explanation for this pattern may be that the tax increase becomes less salient. After the implementation of the reform – which takes place three quarters after the press announcement in the majority of cases – the prices decrease again and remain 3% below their trend also at the end of the event window. This effect is again estimated with statistical precision. The point estimate corresponds to a reduced price of approximately 30 Euros per square meter or 5,000 Euros for an average house in our sample. In a bargaining model, Kopczuk and Munroe (2015) show that the party with lower bargaining power bears a lower share of the tax. Following this line of argument, it can be concluded that in our case sellers have on average less bargaining power.

In a next step, we test for effects on the number of offered houses. The right panel of Figure 3 plots the results and again shows flat pre-trends. Following the press announcement, the number of listings decreases by approximately 6%. Analogously to the development of prices, offers increase again subsequently. However, two quarters after the announcement the obtained results are not statistically different from zero anymore and remain so until the end of our event window.

The empirically observed price reduction in our event study turns out to be higher than the increase in the tax burden which should theoretically correspond to an increase of 1% in the price a buyer has to pay following a tax hike of one percentage point. This effect is similar to existing studies for Germany. Dolls et al. (2019) and Petkova and Weichenrieder (2017) stress that capitalization effects can explain this finding. If a property is expected to be traded more frequently in the future, the permanently higher tax rate also burdens future transactions. Best and Kleven (2018) emphasise that when taking into account down-payment constraints, transaction taxes can have very large effects on both prices and transaction volumes if households are highly leveraged. Such constraints exist in Germany because RETT payments, in general, cannot be financed by borrowing.

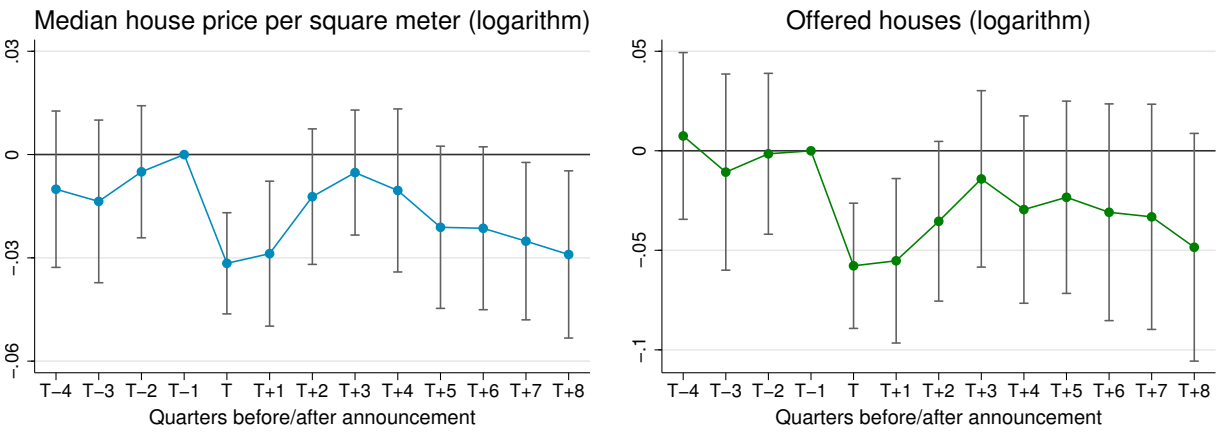


Figure 3: Baseline results. The figure plots event study estimates and corresponding 95% confidence bands. The dependent variables are the log median house price per square meter in the left-hand panel, and the log number of offered houses in the right-hand panel. The event is given by the announcement of a one percentage point tax increase in press. Estimations include county and time × district fixed effects. Standard errors are clustered at the county level.

4.2 Heterogeneous effects

To study potentially heterogeneous developments between different types of counties, we repeat our analysis for four distinct subgroups. We distinguish between shrinking and growing as well as peripheral and central counties based on classifications by the Federal Institute for Research on Building, Urban Affairs and Spatial Development as described in Section 2.2. Panel A in Figure 4 summarises our findings for prices, while Panel B depicts the results for the number of offered houses.

When splitting our sample into shrinking and growing counties, we find heterogeneous effects. In shrinking counties, asking prices are corrected downwards strongly by approximately 8% in the two quarters subsequent to the announcement. At the end of the event window, the point estimate is twice as large as compared to our baseline estimation and statistically significantly different from zero. Apart from a negative announcement effect, no significant impact can be identified for growing counties. The point estimates are close to zero. The same holds for the number of offers. This implies that the economic incidence of the RETT falls on the buyer in these regions. Additionally, we divide the universe of German counties into peripheral and central counties. For both types, we find negative announcement effects for prices and quantities which, however, do not persist until the end of the event window.

In sum, our results indicate that sellers bear the burden of the tax increase in shrinking counties. One explanation is that down-payment constraints are stronger in these counties. Moreover, a longer period of lower offers points to the relevance of lock-in effects. On the contrary, after an adjustment period, the average price decrease does not offset the increased tax burden for buyers in growing, central and peripheral counties.

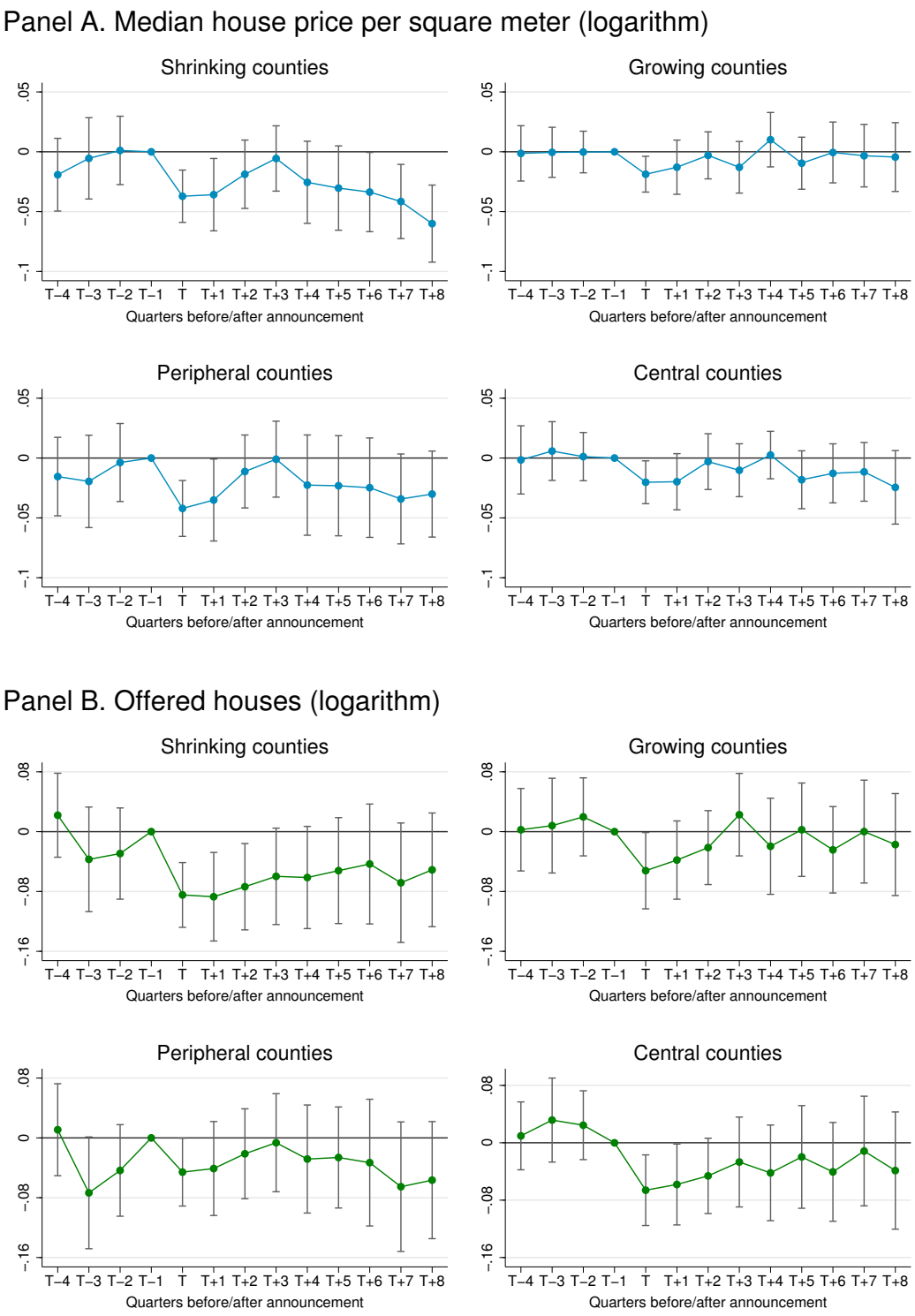


Figure 4: Heterogeneous effects. The figures plot event study estimates and corresponding 95% confidence bands. The dependent variable is the log median house price per square meter in Panel A and the log number of offered houses in Panel B. The event is given by the announcement of a one percentage point tax increase in press. The upper left hand figure in both Panels includes only shrinking counties, the upper right hand figure only growing counties based on the classifications by the BBSR. The lower left hand figure in both Panels includes only peripheral counties and the lower right hand figure only central counties. Estimations include county and time × district fixed effects. Standard errors are clustered at the county level.

4.3 Robustness checks

In our baseline estimations, the event we analyse is defined as the announcement of a one percentage point tax increase in the press. As a robustness check, we consider tax increases without accounting for the magnitude of the tax hike. In this context, a dummy variable accounts for the multiplicity of events but assumes an identical treatment intensity irrespective of the size of changes in the RETT rate. Consequently, the size of the effect on prices and quantities differs. However, as shown in Figure A5 in the Appendix, qualitatively identical reactions are obtained for the whole sample as well as for the subgroups that we studied in our baseline analysis. In all specifications, we find flat pre-trends. Prices decrease significantly after the announcement. We observe persistent price reductions in shrinking counties. Unlike in our baseline estimation, also in central counties the effect is statistically significantly negative at the end of our event window. Temporarily, fewer houses are offered shortly after the announcement in these two subgroups.

Additionally, we add further controls to the model to account for business cycle shocks and changes in the real estate market at the county level. Taking into account the mean disposable income of households at the county level, asking prices of rents as well as the number of building permits per 1,000 inhabitants does not alter our results. We report the results in Figure A6 in the Appendix.[10]

During our sample period, mergers and splits took place in several counties. In our baseline estimations, we exclude all counties after such changes were implemented. Figure A7 in the Appendix depicts the results of estimations when we exclude all 38 counties that experienced mergers or splits completely. Results hardly differ and support the insights of the baseline analysis.

In a further robustness check, we implement event study estimations using altered event window sizes. Based on our baseline specification, we test for effects including eight quarters prior and subsequent to the announcement as well as a specification with a symmetric window size using six quarters. Figure A8 in the Appendix depicts the event study estimates for these two alternative event window sizes. Again, we find flat pre-trends, a significant announcement effect and persistent negative price effects.

Finally, we exclude individually one of the 16 German states at a time from our estimations. Figures A9 and A10 in the Appendix depict our findings for prices and offers, respectively. All estimations display a similar pattern. In particular, the negative announcement effect on house prices as well as offers can be observed in all specifications. This suggests that our results are not driven by counties in a single state.

[10] We also employ these variables as left-hand-side variables in our event study setup and find flat pre-trends, see Figure A4 in the Appendix.

5 Conclusions

The incidence of transaction taxes in general and the RETT in particular has been discussed intensively in recent times. Employing an event study design, we exploit a large scale constitutional reform of fiscal federalism in Germany in 2006 that re-allocated the authority to set the rates of the RETT to the state level, the German Länder. The states, with the exception of Bavaria and Saxony, have used their newly gained discretion with respect to the RETT to increase the rates to varying levels, in different steps and at alternative points in time. This variation across time and between states is exploited in our analysis.

In our empirical analysis, we identify remarkable anticipation effects for prices and quantities. The majority of tax changes is already announced in press three quarters before implementation. We find strong reductions of asking prices in reaction to these announcements of 3% already in the quarter of the announcement. As an increase of the tax rate of one percentage point increases the price a buyer has to pay by approximately 1%, this means that the price decrease is higher than the increase in the tax burden. Furthermore, the offers of houses are reduced up to 6% in the quarter of the announcement.

However, these effects vary across counties. In shrinking counties, asking prices are persistently corrected downwards, while there is no systematic and persistent adjustments in growing counties such that the buyers bear the additional tax burden. In case of offers, we find negative anticipation effects for both types of counties. However, in case of shrinking counties, this negative adjustment prevails for a longer time. This indicates that lock-in effects are stronger in these counties. Price and quantity decreases are only temporary in peripheral as well as central counties. Thus, the incidence of the RETT is heterogeneous.

References

Agarwal, S., K. Li, Y. Qin, J. Wu, and J. Yan (2020). Tax evasion, capital gains taxes, and the housing market. *Journal of Public Economics 188*, 104222.

Besley, T., N. Meads, and P. Surico (2014). The incidence of transaction taxes: Evidence from a stamp duty holiday. *Journal of Public Economics 119*, 61–70.

Best, M. C. and H. J. Kleven (2018). Housing market responses to transaction taxes: Evidence from notches and stimulus in the U.K. *The Review of Economic Studies 85*(1), 157–193.

Buettner, T. (2017). Welfare costs of the real estate transfer tax. CESifo Working Paper No. 6321.

Buettner, T. and M. Krause (2020). Fiscal equalisation as a driver of tax increases: Empirical evidence from Germany. *International Tax and Public Finance*, https://doi.org/10.1007/s10797–020–09610–9.

Dachis, B., G. Duranton, and M. A. Turner (2011). The effects of land transfer taxes on real estate markets: Evidence from a natural experiment in Toronto. *Journal of Economic Geography 12*(2), 327–354.

Davidoff, I. and A. Leigh (2013). How do stamp duties affect the housing market? *Economic Record 89*(286), 396–410.

Dolls, M., C. Fuest, C. Krolage, and F. Neumeier (2019). Who bears the burden of real estate transfer taxes? Evidence from the German housing market. ifo Working Paper No. 308.

Fritzsche, C. and L. Vandrei (2019). The German real estate transfer tax: Evidence for single-family home transactions. *Regional Science and Urban Economics 74*, 131–143.

Hilber, C. A. and T. Lyytikäinen (2017). Transfer taxes and household mobility: Distortion on the housing or labor market? *Journal of Urban Economics 101*, 57–73.

Ihlanfeldt, K. and T. M. Shaughnessy (2004). An empirical investigation of the effects of impact fees on housing and land markets. *Regional Science and Urban Economics 34*(6), 639–661.

Janeba, E. and J. D. Wilson (2011). Optimal fiscal federalism in the presence of tax competition. *Journal of Public Economics 95*(11-12), 1302–1311.

Kaas, L., G. Kocharkov, E. Preugschat, and N. Siassi (2020). Low homeownership in Germany—a quantitative exploration. *Journal of the European Economic Association*, https://doi.org/10.1093/jeea/jvaa004.

Kopczuk, W. and D. Munroe (2015). Mansion tax: The effect of transfer taxes on the residential real estate market. *American Economic Journal: Economic Policy 7*(2), 214–257.

Krause, M. and N. Potrafke (2020). The real estate transfer tax and government ideology: Evidence from the German states. *FinanzArchiv 76*(1), 100–120.

Lundborg, P. and P. Skedinger (1999). Transaction taxes in a search model of the housing market. *Journal of Urban Economics 45*(2), 385–399.

Mertens, K. and M. O. Ravn (2011). Understanding the aggregate effects of anticipated and unanticipated tax policy shocks. *Review of Economic Dynamics 14*(1), 27–54.

Petkova, K. and A. J. Weichenrieder (2017). Price and quantity effects of the German real estate transfer tax. CESifo Working Paper No. 6538.

Schmidheiny, K. and S. Siegloch (2019). On event study designs and distributed-lag models: Equivalence, generalization and practical implications. CESifo Working Paper No. 7481.

Slemrod, J., C. Weber, and H. Shan (2017). The behavioral response to housing transfer taxes: Evidence from a notched change in D.C. policy. *Journal of Urban Economics 100*, 137–153.

A Appendix

A.1 Additional Tables

Table A1: Summary Statistics 2007Q1-2017Q4

Variable	Measurement	Mean	Std. Dev.	Min.	Max.
RETT rate	In %	4.24	0.95	3.5	6.5
RETT raises	Binary	0.03	0.17	0	1
Median price per square meter[a]	In EUR	1,529.71	663.13	352.64	6,781.58
Median total price[a]	In EUR	234,617.35	106,991.54	43,540	1,095,000
Real estate offerings[a]	Frequency	407.10	406.62	7	6686
Shrinking counties[b]	Binary	0.43	0.50	0	1
Growing counties[b]	Binary	0.57	0.50	0	1
Peripheral counties[c]	Binary	0.38	0.48	0	1
Central counties[c]	Binary	0.62	0.48	0	1
Household disposable income	Euro per capita	20,186.06	2,987.49	3,996.43	40,204
Building permits	Per 1,000 inhabitants	2.60	1.66	0.14	15.6
Rents[d]	Ordinal	3.48	1.50	1	14

[a] *Median of asking purchasing prices (per square meter) as stated in monthly new real estate advertisements on the online real estate platform ImmobilienScout24 and sum of new advertisements (see 'Boelmann, B. and S. Schaffner (2019). Real estate data for Germany (RWI-GEO-RED v1) - Advertisements on the internet platform ImmobilienScout24 2007-03/2019. RWI FDZ Data description.').*

[b] *Further details on the structural classification as shrinking or growing counties as well as data can be found in 'Federal Institute for Research on Building, Urban Affairs and Spatial Development (2016). Technical details on the structural classification of county types (shrinking/growing). https://www.bbsr.bund.de/BBSR/DE/Raumbeobachtung/Raumabgrenzungen/deutschland/kreise/wachsend-schrumpfend-kreise/download-RefWachsSchr.xlsx'.*

[c] *Further details on the structural classification as central or peripheral counties as well as data can be found in 'Federal Institute for Research on Building, Urban Affairs and Spatial Development (2015). Technical details on the structural classification of county types (central/peripheral). https://www.bbsr.bund.de/BBSR/DE/forschung/raumbeobachtung/Raumabgrenzungen/ deutschland/kreise/Raumtypen2010_krs/Download_RefLageKrs.xlsx'.*

[d] *Ordinal classification of average asking rents per square meter starting from the category below 4 Euros per square meter with subsequent categories in 1 Euro steps up to 17 Euros and more per square meter.*

Table A2: Overview of the dates of the legal implementation, legal draft and press announcement of changes in the real estate transfer tax

State	# of tax change	RETT rate	Date of legal implementation	Date of first legal draft	Date of first press announcement	Source of first press announcement
Baden-Württemberg	1st change	5.0%	05.11.2011	13.09.2011	05.01.2011	Handelsblatt
Bavaria[a]	-	3.5%	-	-	-	-
Berlin	1st change	4.5%	01.01.2007	07.11.2006	02.11.2006[b]	Süeddeutsche Zeitung
	2nd change	5.0%	01.04.2012	18.01.2012	12.11.2011	Berliner Zeitung
	3rd change	6.0%	01.01.2014	10.10.2013	22.06.2013	Berliner Morgenpost
Brandenburg	1st change	5.0%	01.01.2011	13.09.2010	08.04.2010	Berliner Morgenpost
	2nd change	6.5%	01.07.2015	04.03.2015	24.11.2014	Berliner Morgenpost
Bremen	1st change	4.5%	01.01.2011	22.06.2010	04.02.2010	Börsen Zeitung
	2nd change	5.0%	01.01.2014	09.07.2013	08.07.2013	Nordwest Zeitung
Hamburg	1st change	4.5%	01.01.2009	14.10.2008	22.07.2008	Hamburger Morgenpost
Hesse	1st change	5.0%	01.01.2013	25.09.2012	17.04.2012	Frankfurter Allgemeine Zeitung
	2nd change	6.0%	01.08.2014	13.05.2014	18.12.2013	Frankfurter Allgemeine Zeitung
Lower Saxony	1st change	4.5%	01.01.2011	31.08.2010	08.04.2010	Schweriner Volkszeitung
	2nd change	5.0%	01.01.2014	17.09.2013	14.02.2013	Bayerische Rundschau
Mecklenburg-Western Pomerania	1st change	5.0%	01.07.2012	14.02.2012	28.10.2011	Schweriner Volkszeitung
North Rhine-Westphalia	1st change	5.0%	01.10.2011	10.05.2011	16.02.2011	DPA
	2nd change	6.5%	01.01.2015	28.10.2014	03.07.2014	Rheinische Post
Rhineland-Palatinate	1st change	5.0%	01.03.2012	23.11.2011	03.05.2011	Darmstädter Echo
Saarland	1st change	4.0%	01.01.2011	19.10.2010	08.07.2010	Saarbrücker Zeitung
	2nd change	4.5%	01.01.2012	18.10.2011	22.06.2011	Immobilien Zeitung
	3rd change	5.5%	01.01.2013	08.10.2012	26.03.2012	Mitteldeutsche Zeitung
	4th change	6.5%	01.01.2015	07.10.2014	05.06.2014	Frankfurter Allgemeine Zeitung
Saxony[a]	-	3.5%	-	-	-	-
Saxony-Anhalt	1st change	4.5%	02.03.2010	30.09.2009	30.09.2009[c]	-
	2nd change	5.0%	01.03.2012	28.09.2011	23.06.2011	dapd
Schleswig-Holstein	1st change	5.0%	01.01.2012	23.08.2010	08.04.2010	Schweriner Volkszeitung
	2nd change	6.5%	01.01.2014	26.07.2013	13.03.2013	Heilbronner Stimme
Thuringia	1st change	5.0%	07.04.2011	06.01.2011	29.09.2010	Handelsblatt
	2nd change	6.5%	01.01.2017	23.09.2015	09.09.2015	Meininger Tageblatt

[a] *States refrained from changing the real estate transfer tax rate after the constitutional reform and kept the prior uniform rate of 3.5%.*
[b] *In the empirical analysis, the date of the press announcement is set to 2007Q1.*
[c] *As no prior press coverage was found, the date of the press announcement was set to the date of the legal draft. Therefore, no source for the press announcement is indicated.*

A.2 Additional Figures

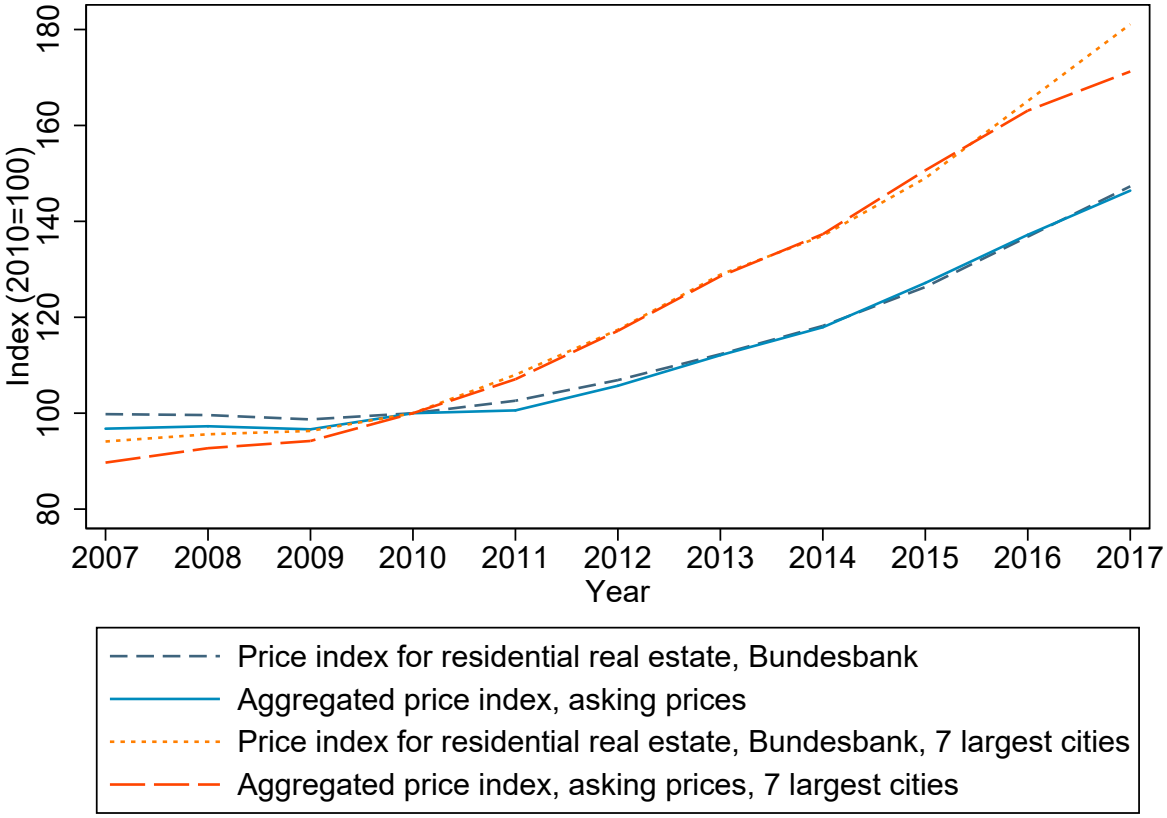


Figure A1: Comparison of price indices (2010=100). The figure compares the price indices for residential real estate provided by the Deutsche Bundesbank with aggregated indices constructed by population weighted asking prices from our dataset. The first set comprises all counties and county-free cities, the second set comprises the seven large cities Berlin, Cologne, Duesseldorf, Frankfurt on the Main, Hamburg, Munich, and Stuttgart.

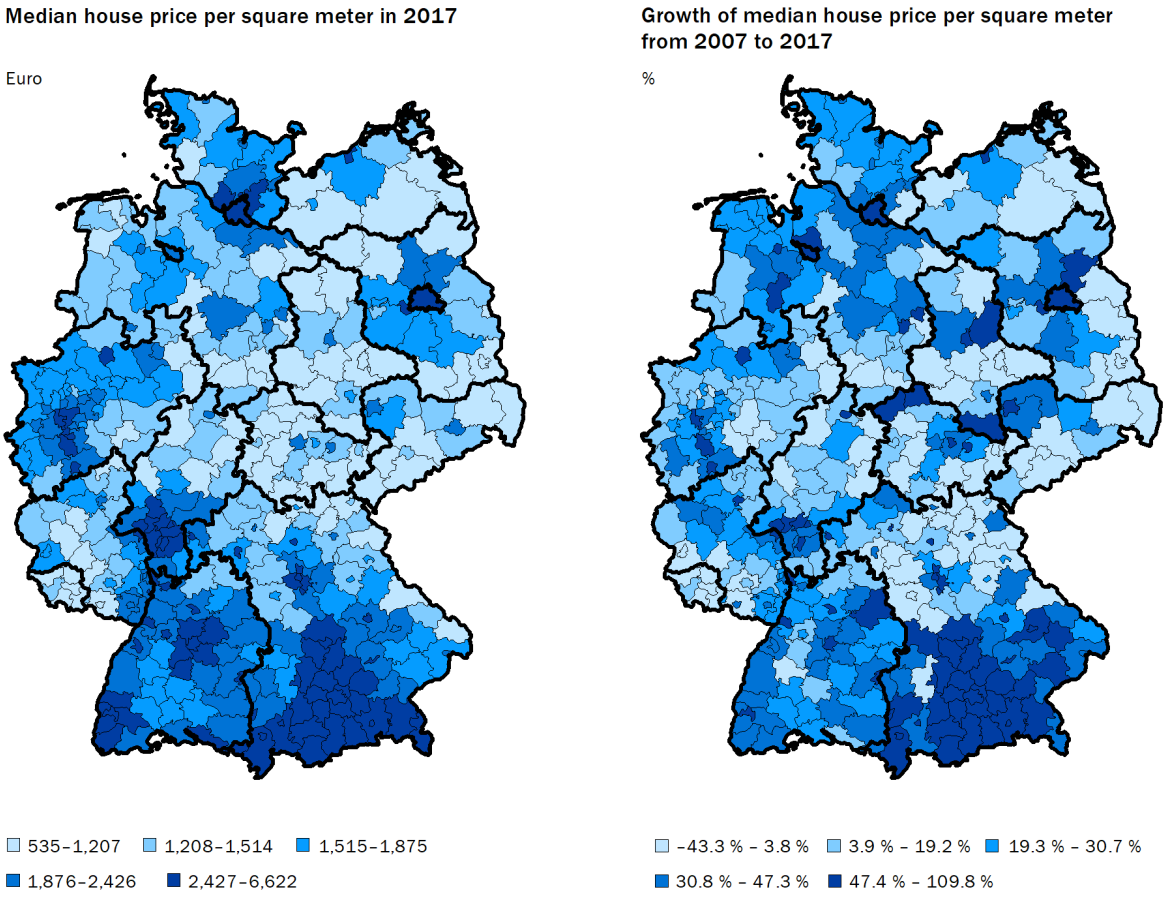


Figure A2: Distribution of the median house prices per square meter in 2017 as well as their growth in the sample period. Calculation of thresholds based on quintiles; deviations due to rounding for display purposes.

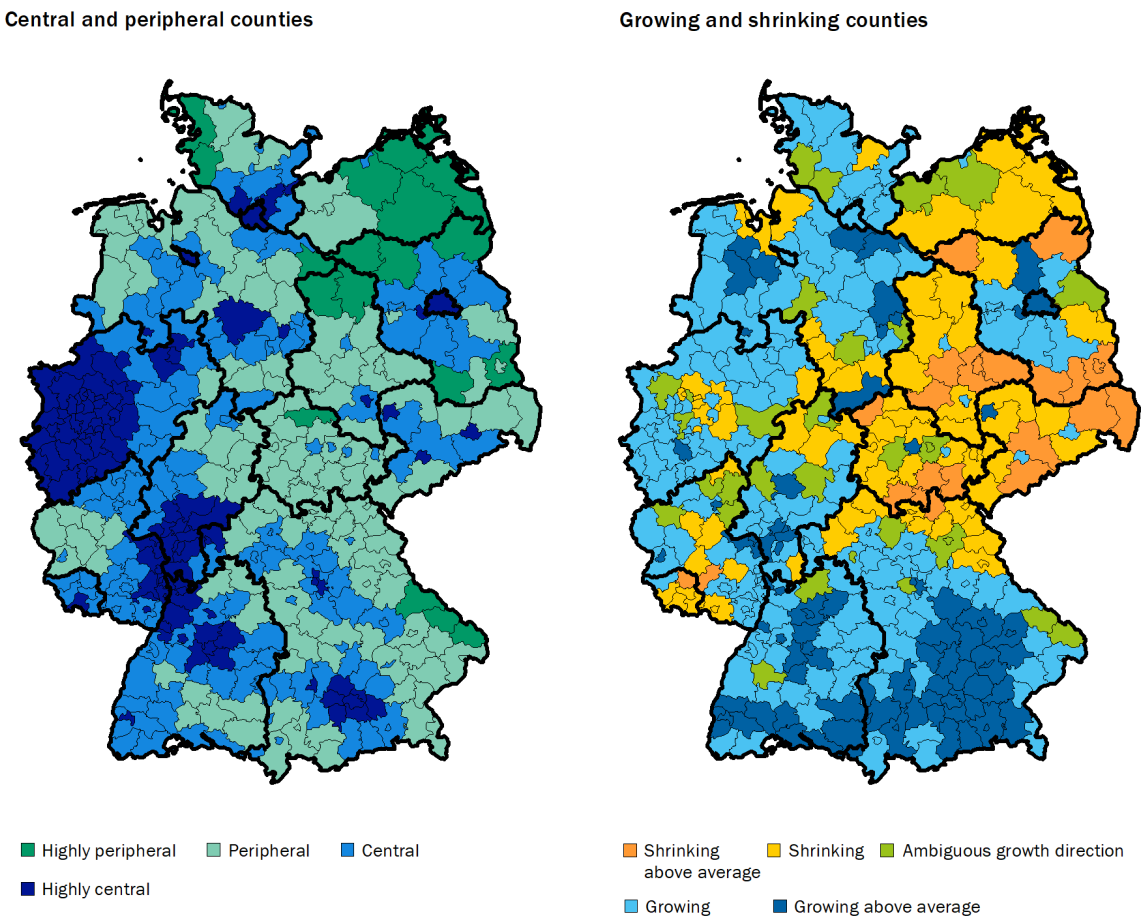


Figure A3: Classification and regional distribution of county types. Calculation of thresholds based on quintiles; deviations due to rounding for display purposes.

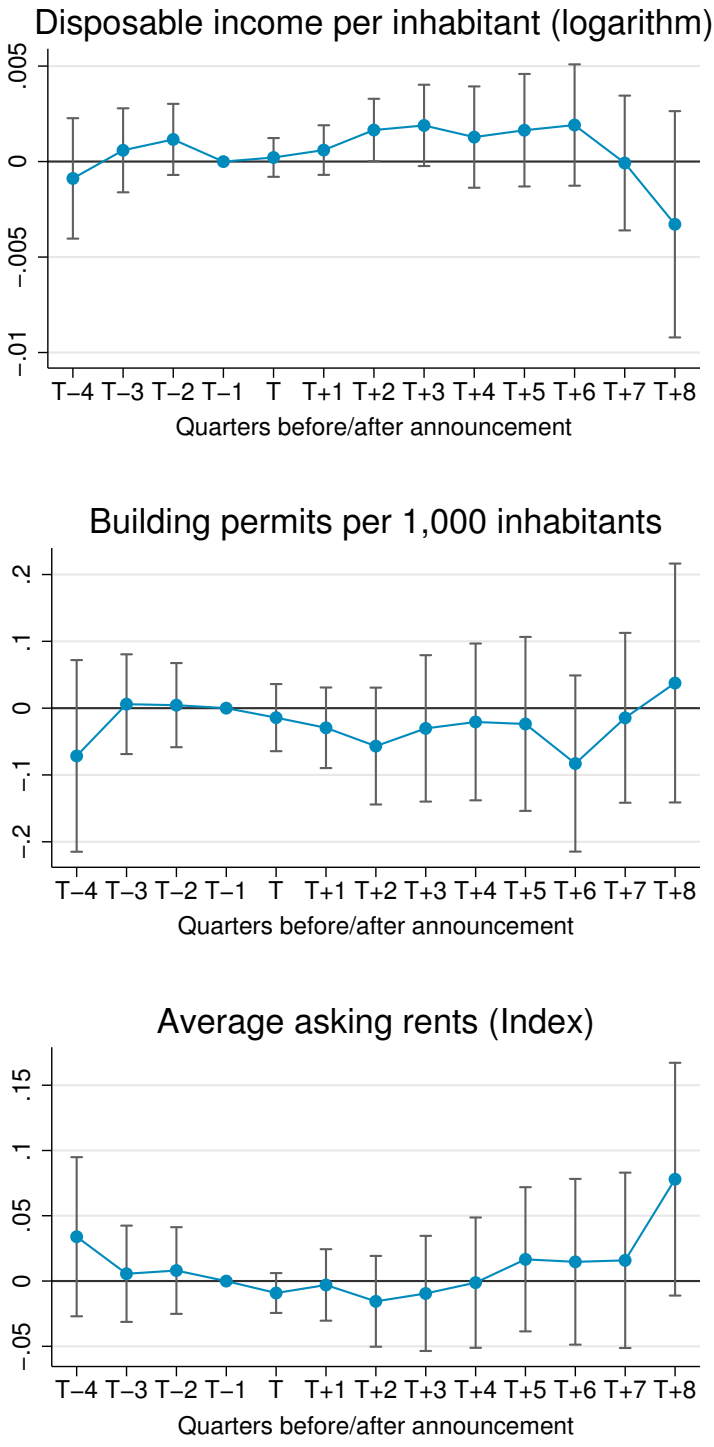


Figure A4: Robustness check: Local business cycle effects and housing market effects. The figures plot event study estimates and corresponding 95% confidence bands. In the upper panel, the dependent variable is the log disposable income per inhabitant. In the middle panel, the dependent variable is the number of building permits per 1,000 inhabitants. In the lower panel, the dependent variable is an index for the average asking rents. The event is the announcement of a one percentage point tax increase in press. Estimations include county and time × district fixed effects. Standard errors are clustered at the county level.

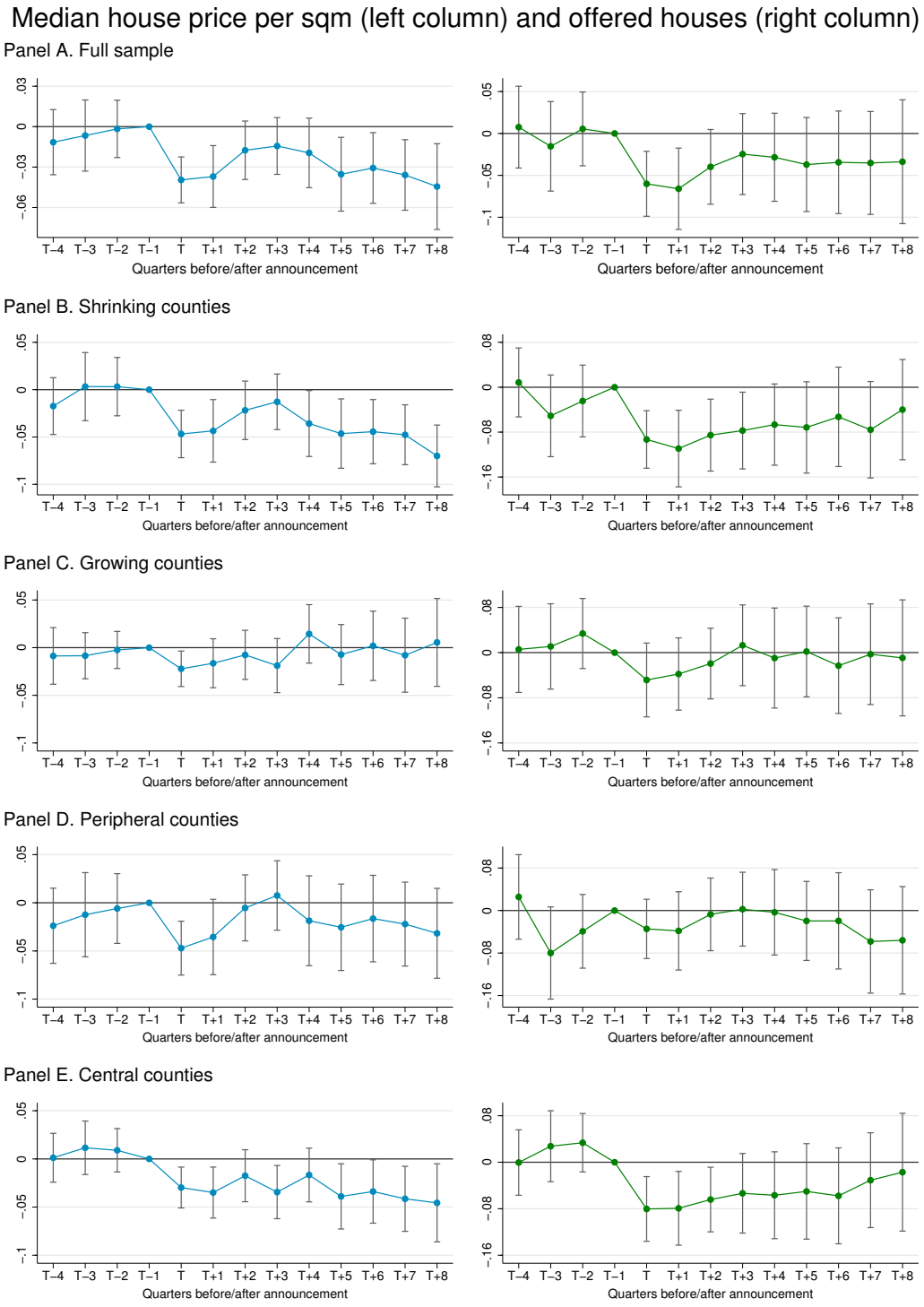


Figure A5: Robustness check: Measuring of treatment. The figure plots event study estimates and corresponding 95% confidence bands. The dependent variables in the left column is the log median house price per square meter, and the log number of offered houses in the right column. The event is given by the announcement of a tax increase in press. The treatment is measured as dummy variable which accounts for the multiplicity of events but assumes an identical treatment intensity irrespective of the size of changes in the tax rate. Panel A includes all counties. Panels B-E plot estimations for subgroups of counties. Estimations include county and time × district fixed effects. Standard errors are clustered at the county level.

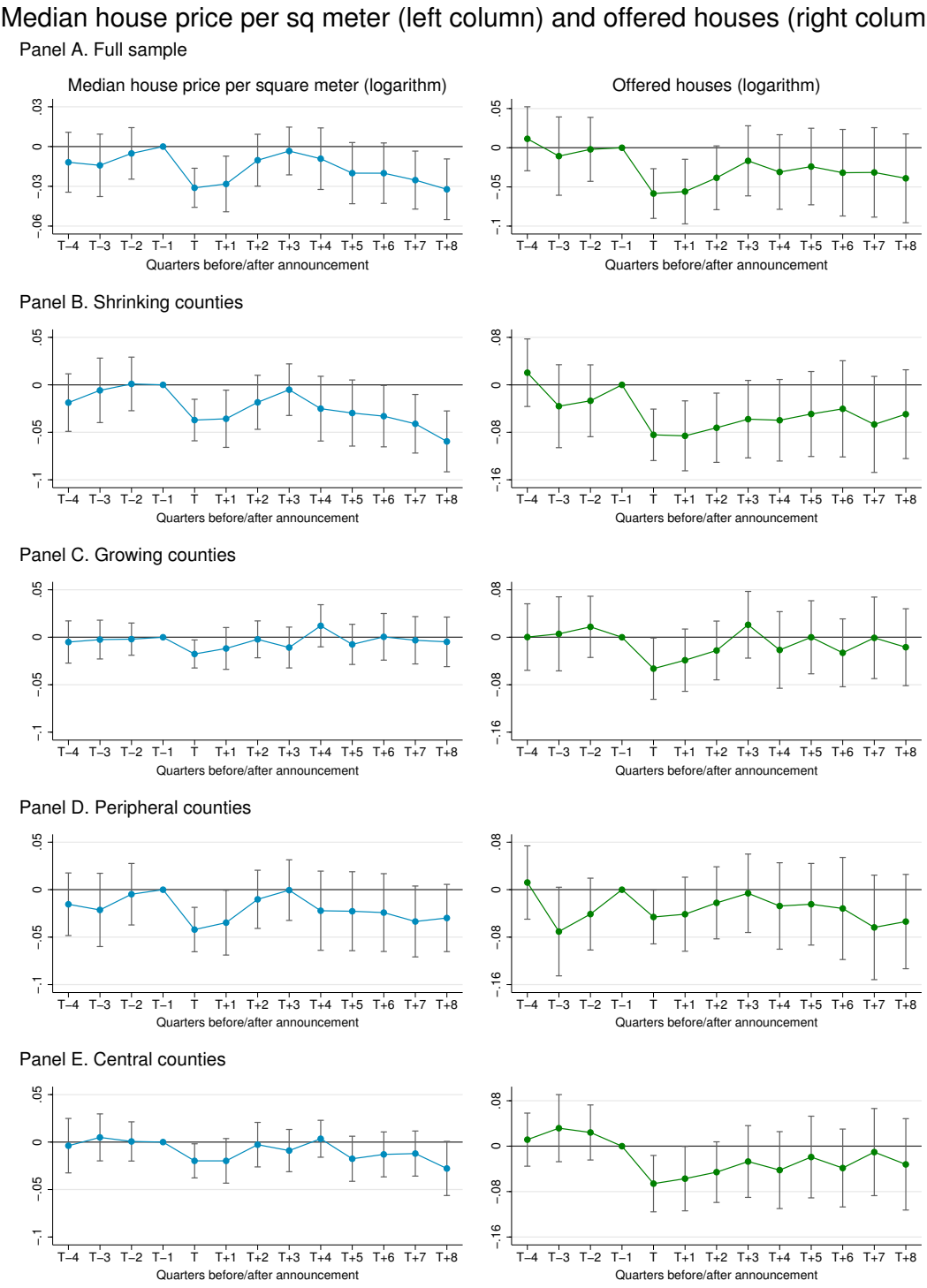


Figure A6: Robustness check: Additional control variables. The figure plots event study estimates and corresponding 95% confidence bands. The estimations include three additional control variables: log disposable income per inhabitant, the number of building permits per 1,000 inhabitants, and average asking rents. The dependent variables are the log median house price per square meter in the left-hand panel, and the log number of offered houses in the right-hand panel. The event is given by the announcement of a one percentage point tax increase in press. Estimations include county and time × district fixed effects. Standard errors are clustered at the county level.

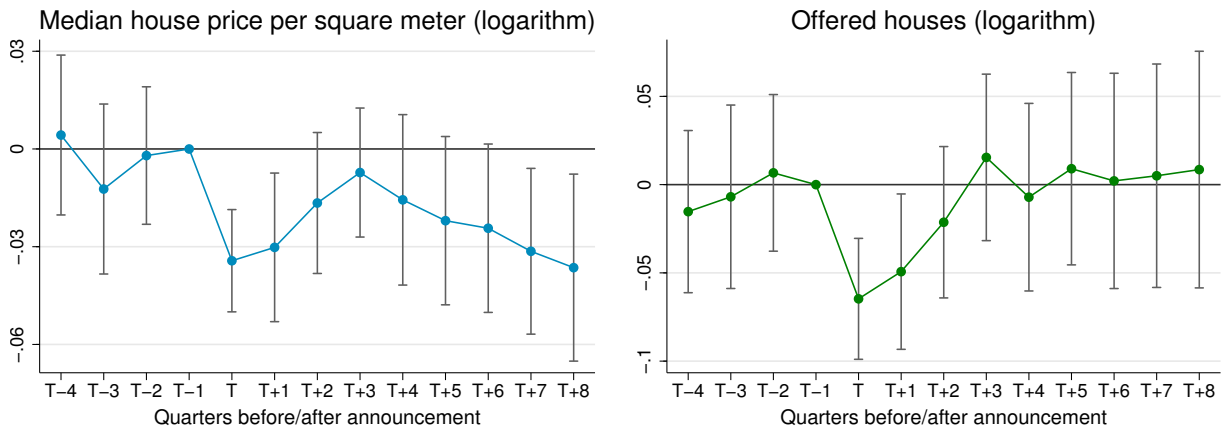
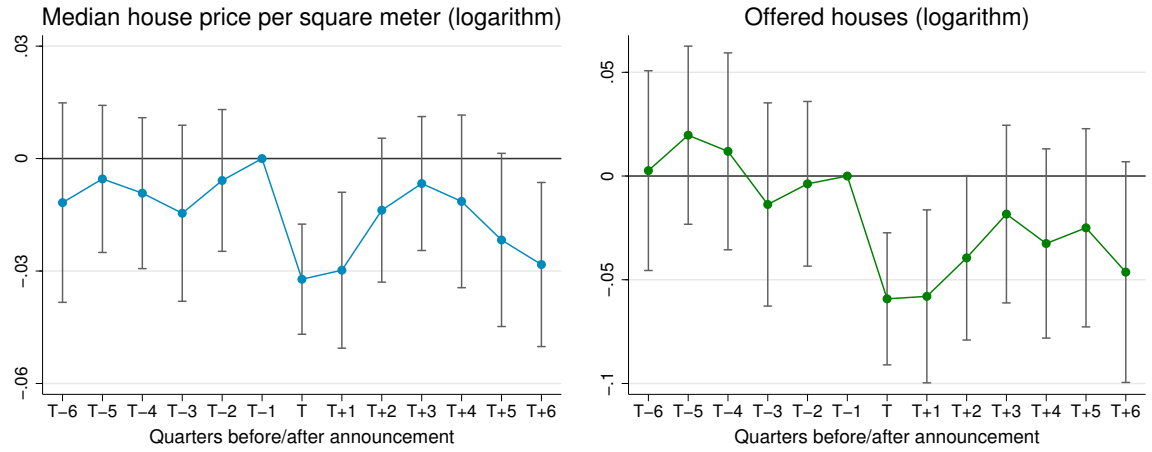


Figure A7: Robustness check: Excluding counties with mergers and splits. The figure plots event study estimates and corresponding 95% confidence bands. 38 counties that experienced splits or mergers during our sample period are excluded. The dependent variables are the log median house price per square meter in the left-hand panel, and the log number of offered houses in the right-hand panel. The event is given by the announcement of a one percentage point tax increase in press. Estimations include county and time × district fixed effects. Standard errors are clustered at the county level.

Panel A. Event window: 6 quarters prior and after announcement



Panel B. Event window: 8 quarters prior and after announcement

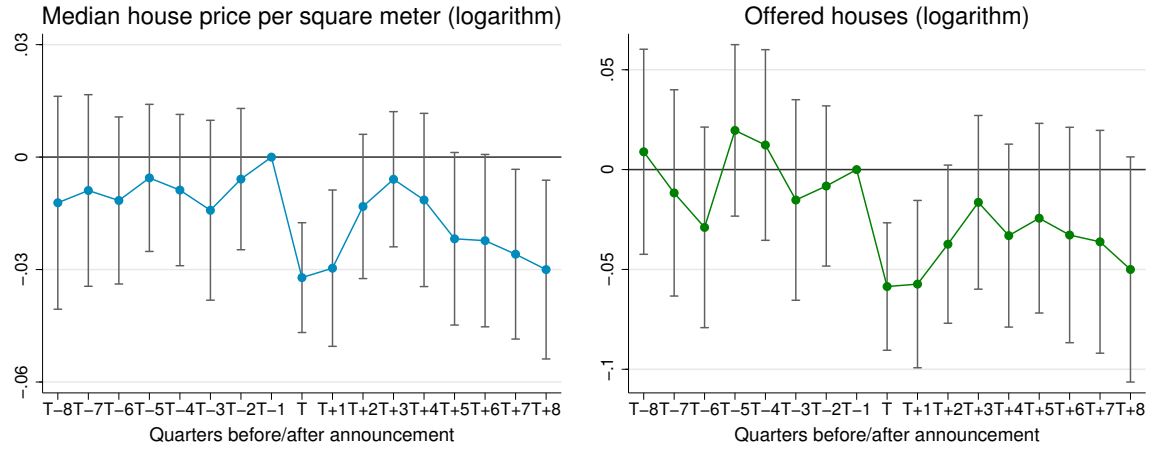


Figure A8: Robustness check: Different event windows. The figure plots event study estimates and corresponding 95% confidence bands for two alternative event windows running from 6 (8) quarters prior to the announcement to 6 (8) quarters after the announcement. The dependent variable is the log median house price per square meter. The event is given by the announcement of a one percentage point tax increase in press. Estimations include county and time × district fixed effects. Standard errors are clustered at the county level.

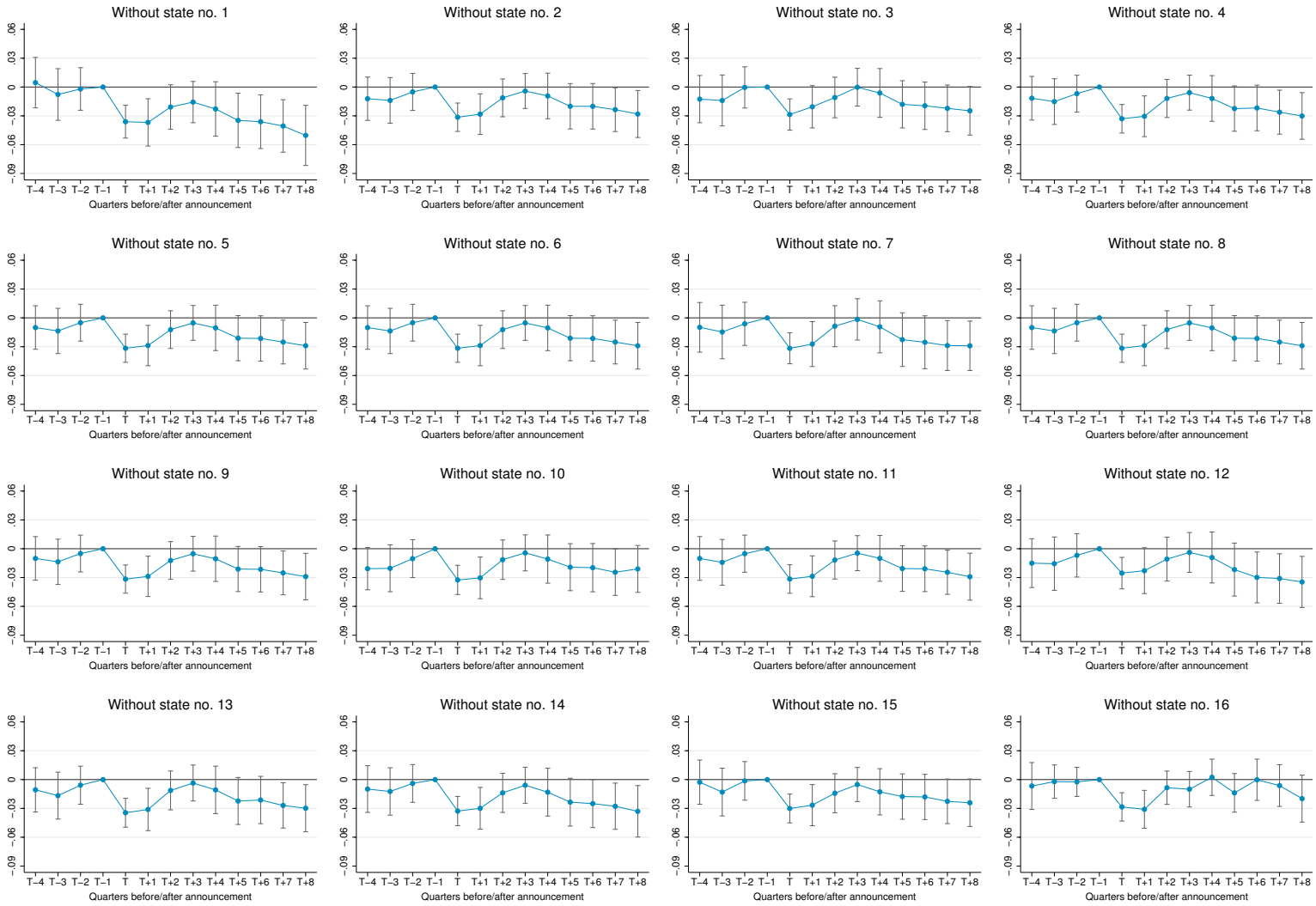


Figure A9: Robustness check: Exclusion of states, prices. 1-Schleswig-Holstein, 2-Hamburg, 3-Lower Saxony, 4-Bremen, 5-North Rhine-Westphalia, 6-Hesse, 7-Rhineland-Palatinate, 8-Baden-Wuerttemberg, 9-Bavaria, 10-Saarland, 11-Berlin, 12-Brandenburg, 13-Mecklenburg-Vorpommern, 14-Saxony, 15-Saxony-Anhalt, 16-Thuringia. The figure plots event study estimates and corresponding 95% confidence bands. The dependent variable is the log median house price per square meter. In each panel one of the 16 states is excluded from the estimation. The event is given by the announcement of a one percentage point tax increase in press. Estimations include county and time × district fixed effects. Standard errors are clustered at the county level.

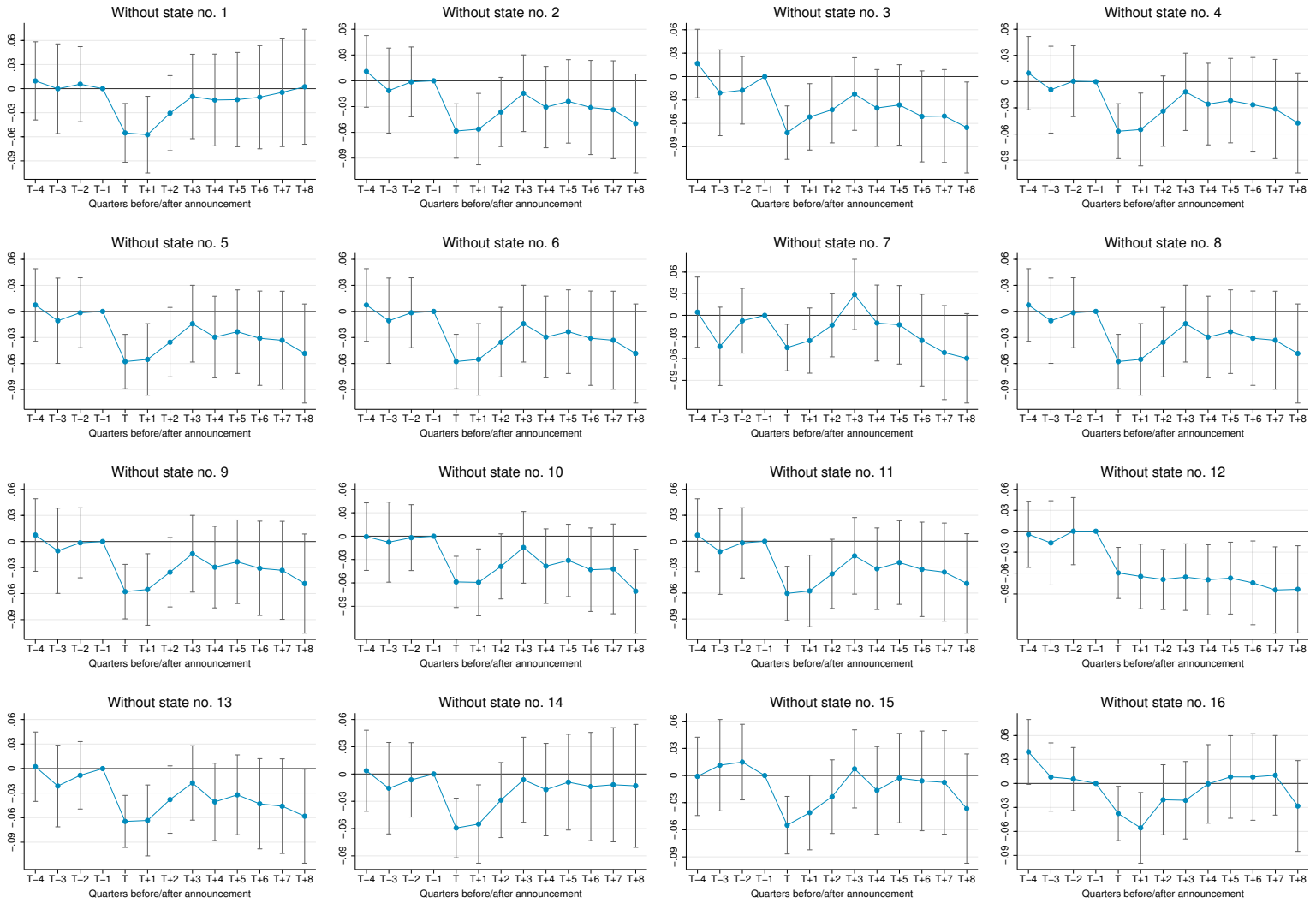


Figure A10: Robustness check: Exclusion of states, offers. 1-Schleswig-Holstein, 2-Hamburg, 3-Lower Saxony, 4-Bremen, 5-North Rhine-Westphalia, 6-Hesse, 7-Rhineland-Palatinate, 8-Baden-Wuerttemberg, 9-Bavaria, 10-Saarland, 11-Berlin, 12-Brandenburg, 13-Mecklenburg-Vorpommern, 14-Saxony, 15-Saxony-Anhalt, 16-Thuringia. The figure plots event study estimates and corresponding 95% confidence bands. The dependent variable is the log number of offered houses. In each panel one of the 16 states is excluded from the estimation. The event is given by the announcement of a one percentage point tax increase in press. Estimations include county and time × district fixed effects. Standard errors are clustered at the county level.