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ABSTRACT

The 2015 European Refugee Crisis and Residential Housing Rents in Germany*

We study the impact of the 2015 mass arrival of refugees to Germany on residential housing rents. Using unique data on end of year county-level refugee populations and data on monthly offers of flats for rent from Germany's leading online property broker *Immobilienscout24*, we find strong evidence in difference-in-differences regressions for a negative effect of refugee immigration on rental prices. Adverse price effects, however, appear attenuated in the heyday of the crisis in late 2015 if a larger share of refugees is housed in decentralized accommodation. Various robustness checks corroborate our findings, including IV regressions that exploit for identification information on the pre-crisis location of refugee reception centers and group quarters.

JEL Classification: F22, R23, R21, R31

Keywords: refugee migration, housing rents, Germany

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* We thank Thomas Cornelissen, Christian Dustmann, Alexander Fink, David A. Jaeger, Hyejin Ku, Jon O. Olaussen, Sebastian Otten, Are Oust, Gregor Pfeifer, Filipa Sá, Rosa Sanchis-Guarner, Uta Schönberg, participants of the 2018 NTNU Business School Conference & PhD Seminar in Trondheim, the 2018 1st EAYE Workshop on Housing and Macroeconomics in Leipzig, the 2018 15th International Migration, Integration and Social Cohesion in Europe (IMISCOE) Annual Conference in Barcelona, the 2018 25th Annual Conference of the European Real Estate Society (ERES) in Reading, the 1st CReAM/RWI Workshop on the Economics of Migration in Essen and seminars at the Center for European Economic Research (ZEW) in Mannheim, at RWI - Leibniz Institute for Economic Research in Essen, the UHH in Hamburg, and the CReAM Brown Bag Seminar at UCL for their valuable comments. Eren Aydin, Felix Bransch and Robert Lange provided excellent research assistance. The research in this paper was funded by Deutsche Forschungsgemeinschaft (grant no. KV 58/2-1, "Deutschland und die Flüchtlingskrise im Jahr 2015"). All remaining errors are our own.

1 Introduction

In the course of the 2015 European refugee crisis, which was fueled by the conflict in the Syrian Arab Republic (Middelhoff, 2015), nearly one million refugees flowed into Germany, making it the biggest recipient country in absolute terms in the EU (Daldrup, 2016).[1] Housing individuals from this largest refugee inflow to Germany since the early 1990s (BAMF, 2016a) posed great challenges for state and local authorities, particularly in the heyday of the refugee crisis, in late 2015 and early 2016 (FOCUS, 2015a). The sudden and large-scale immigration also raised concerns in the public that natives would face fiercer competition for rental units and potentially higher rental costs (Heising, 2015; Psotta, 2015), that socially deprived areas might develop (van Suntum, 2015), leading to ghettoization (Kather, 2015), and that refugee group quarters might adversely affect the value of rental units and privately owned property located in their vicinity (FOCUS, 2015b; Laufer, 2015; Stoldt, 2014). Little is known, however, on whether such fears had, and have, any justification. Empirical research remains scarce and is lacking for both Germany and other Eurozone countries.[2] Furthermore, the broader literature on immigration and housing markets provides little guidance, given its mixed findings and dominant focus on economic rather than forced migration. Addressing this gap in the literature, we provide a first comprehensive analysis of the impact that the 2015 mass arrival of refugees to Germany had on residential housing rents. For methodological reasons, we limit the focus of our analysis to the shorter run impacts of refugee immigration in late 2015 and early 2016. This restriction in focus aids identification, as it limits the scope for potential endogenous responses in real estate construction activity (supply side responses) and for sizeable out-migration of natives as well as potential endogenous regional relocations of refugees (behavioral responses) that could confound the two primary relationships we investigate in this study between regional rental price growth, the scale of regional refugee immigration, and the regional prevalence of different types of refugee accommodation.

Immigration may impact host economies in multiple ways and in different domains, one being real estate. As housing rents account for a sizeable share of private spending and personal wealth, they are of vital interest to both policy makers and the public at large. This is particularly true for Germany, where the majority (56%) of privately-occupied property is rented (Destatis, 2015), not owner-occupied as in the USA or in Great Britain. Despite its importance, however, real estate has only recently caught the interest of economists inquiring into the consequences of immigration, a field of study traditionally biased in focus towards the labor market. Furthermore, the link (if any), and its sign, is all but clear theoretically and unlikely to be just one dimensional in nature. In particular, two prime effects of opposing sign may be at work. Provided the supply of property is relatively inelastic, immigration-driven increases in the demand for rental accommodation are likely to cause upward pressure on prices (rents). However, and working in the opposite direction, prices of property may also take harm if natives perceive local settlements of immigrants as a disamenity, an adverse effect that may well be stronger for refugee settlements. Which of the two effects dominates is a priori unclear. To answer this question, empirical evidence is required. In this paper, we will provide such evidence for Germany.

[1] We consider as 'refugees' all individuals who arrived in Germany in 2015 and registered informally as seeking protection with the intend to lodge a formal asylum application, irrespective of their later residence status and the outcome of their asylum application. We hence, and henceforth, use the terms 'refugee' and 'asylum seeker' interchangeably. In practice, the classification of individuals into different categories/types of immigrants, in particular refugee migrants and other types of protection-seeking immigrants including asylum seekers, faces various difficulties (Hoesch, 2018).

[2] Three recent studies have explored the consequences of the Syrian refugee crisis for property markets in Turkey (Tumen, 2016; Balkan et al., 2018), respectively Jordan (Alhawarin et al., 2018). A further study (Lastrapes and Lebesmuehlbacher, 2018) has analysed the effects of refugee immigration for property markets in the UK, albeit over an extended period (2004 to 2015) that mostly predates the 2015 crisis. Closely related are also the studies by Saiz (2003) and Kürschner (2016). The seminal study by Saiz (2003) explored the effects of the Mariel Boatlift to Miami, laying the foundation for a new branch of literature in economics on immigration and housing markets. Kürschner (2016), in turn, examined the consequences for regional property markets of the mass influx of East Germans to West Germany following the fall of the Berlin Wall.

Using unique data on end of year (EoY) county-level refugee populations and data on monthly offers of flats for rent from Germany's leading online property broker *Immobilienscout24* in difference-in-differences regressions, we find strong evidence for a sizeable adverse effect of refugee immigration on rental prices. A one percentage point increase in the county-level EoY refugee stock (normalized by the 2014 county population) is associated with a 0.71% lower average rental price growth in the last quarter of 2015, and a 1.11% lower average rental price growth in the first quarter of 2016. Furthermore, we find evidence that adverse price effects are attenuated in the heyday of the crisis in late 2015 if a larger share of refugees is housed in decentralized accommodation, rather than in centralized facilities. Various robustness checks corroborate our findings, including IV regressions that exploit for identification information on the pre-crisis location of refugee reception centers and refugee group quarters. Our first finding stands in contrast to the positive relationship between mass migration and housing rents found in related works (Saiz, 2003; Tumen, 2016; Kürschner, 2016). Natives' perception (justified or unjustified) that local refugee settlements, particularly if concentrated, are more of a disamenity that harms rental prices of property than non-refugee migrant settlements may sign responsible for this difference. Our second finding on heterogeneous treatment effects of refugee immigration by type of refugee accommodation is consistent with this explanation.[3]

Our study relates and contributes to the literature on immigration and real estate in several ways. First and foremost, our study is the first to explore for a Eurozone country the link between regional refugee immigration and regional rental prices of property during the 2015 refugee crisis. Second, using novel and detailed data on county-level refugee populations and their composition, our study is also the first to analyse how different types of refugee accommodation (decentralized vs. centralized)[4] affect residential housing rents, a question of direct relevance for public policy. Third, our study is one of but few studies to consider a sudden, unexpected and sizeable inflow of migrants, a setting that aids identification. From a methodological perspective, our focus on forced migrants carries still further advantages. Economically motivated return migration should be a minor phenomenon at best, selection into migration less selective from origin populations, and selection into destination regions less subject to choice and hence confounding influences, being governed, at least in part, by strict between-state distribution and within-state allocation rules in Germany.[5] Fourth, and notwithstanding this favorable setting for causal inference, we probe the robustness of our results in IV regressions that make use of arguably exogenous variation in regional (forced) migration inflows related to pre-crisis location structures of publicly-run refugee group quarters. Finally, in our hedonic price regressions, we make use of exceptionally detailed information on property characteristics that goes far beyond standard items, such as lot size and age, used in most studies, and control for regional fixed effects in real estate values at a very small administrative level (municipality).

The paper proceeds as follows. Section 2 provides background information on the mass inflow of refugees to Germany in 2015. It also reviews the existing literature on migration (economic or forced) and housing markets.

[3] A repeated choice experiment by Liebe et al. (2018) provides evidence which is consistent with this reading of our results. Investigating the attitudes of Germans towards refugee accommodations in their neighborhoods, the study finds that the majority of Germans rather disapprove of refugee housing in proximity of their neighborhoods and that this view has not changed over the twelve months since November 2015, i.e. the time which saw the internationally much-lauded "culture of welcoming" (*Willkommenskultur*) of the German public at its peak, a culture that received much coverage in the media and was actively promoted by politicians (Dewast and Chaturvedi, 2015; Sueddeutsche Zeitung, 2015). The study also found that about one fifth of the surveyed population which had formerly rather approved of the establishment of refugee accommodations in their vicinity no longer did so in 2016. According to Liebe et al. (2018), this change in attitude may, at least in part, be attributable to growth in *'not in my backyard' (NIMBY)* perceptions (Dear, 1992) among the surveyed population.

[4] Centralized refugee accommodation comprises reception centers and other types of shared housing (i.e. general group quarters) and decentralized refugee accommodation non-shared dwellings, in particular individual flats (Destatis, 2016).

[5] Refugees entering Germany are distributed by authorities across the country's 16 federal states according to the Koenigstein Key *(Königsteiner Schlüssel)*, a pre-defined state-level refugee allocation quota based on demographic and economic characteristics of states. In constructing the key, state populations receive a weight of 1/3 and tax revenues a weight of 2/3. The allocation quota is calculated annually based on tax and population statistics that date two years back (GWK, 2017; German Federal Social Insurance Authority, 2016).

Section 3 outlines our empirical strategy and describes the different data sources we use in the analysis. Section 4 presents and discusses our main findings, probes their robustness in several ways, and considers some additional explorations. Finally, Section 5 summarizes our main findings, discusses potential policy implications, and identifies areas that warrant further research.

2 Background

2.1 Previous Research

Studies on immigration and real estate markets are of fairly recent vintage and still comparatively few in number, although research in this area is proliferating rapidly. In fact, immigration-caused demand shocks to real estate markets have begun to attract growing interest in the migration literature only in the last twenty years. To study their effects, studies in this area of research consider spatial variation in migrant inflows or changes in local shares of immigrant populations and changes in rental prices, house prices, or price indices at various levels of regional aggregation. Most, but not all, analyses in this body of literature control for potential endogeneity in regional migrant settlement patterns that may confound the relationship of interest between such inflows and outcomes on real estate markets. For this purpose, different instrumental variables are used, which exploit for identification historical settlement patterns of migrants, also known as the shift-share approach (Card, 2001), combinations of exogenous origin-specific push factors of migration and the shift-share approach (Saiz, 2007), or geographic proximity between origin and destination regions (Kürschner, 2016).

Empirical studies on immigration and real estate markets have produced mixed findings. Most find a positive relationship between immigration (its scale) and housing rents or prices, some a negative relationship, and some no systematic link of any kind. The former group includes studies for the U.S. (Saiz, 2003, 2007; Ottaviano and Peri, 2007; Mussa et al., 2017), Canada (Akbari and Aydede, 2012; Latif, 2015), Spain (Gonzalez and Ortega, 2013), Switzerland (Degen and Fischer, 2017; Adams and Blickle, 2018), Italy (Kalantaryan, 2013; Accetturo et al., 2014), Germany (Kürschner, 2016), and Turkey (Tumen, 2016; Balkan et al., 2018). Of these studies, a handful is closely related to the present study and exploits (in the majority) a natural experiment setting, considering, like us, a sudden, unexpected and sizeable inflow of migrants. The first of these studies, by Kürschner (2016), explores the effects that the mass exodus of East Germans to West Germany following German reunification in 1990 had on rents in West German metropolitan areas. Her results suggest that this migrant inflow to West Germany led to a sizeable surge in rents. Two other closely-related studies, by Tumen (2016) and Balkan et al. (2018), analyse the consequences of the current refugee crisis for Turkey. These studies also find evidence for a rent increase, albeit of different magnitude across rental market segments, which may be driven by an increased demand for residential segregation with respect to ethnicity. Similarly, exploring the consequences of the Syrian refugee crisis in Jordan, Alhawarin et al. (2018) find evidence that a rising population share of Syrians in the country exerted a negative influence on natives' perceptions of the quality of housing and adversely affected their expectations concerning the future development of rents, particularly among poor households. The results of this study also indicate that regions closer to the Syrian border have been less sensitive to changes in the Syrian population share, which may be partly attributable to the presence of several international donors in the region that enabled municipalities to cope better with the absorption of refugee inflows. Finally, in an analysis for the city of Gothenburg, Kjellander et al. (2018) find that solely the announcement of a temporary building site for refugee housing in the wake of the European refugee crisis sufficed to depress prices of residential property within walking distance to such a site. Complementing these studies, Lastrapes and Lebesmuehlbacher (2018) find evidence for a negative impact of refugee immigration to the UK on low priced dwellings in the years 2004 to 2015, a finding that may be driven by regions that voted to leave the EU in the Brexit referendum. The results of Lastrapes and Lebesmuehlbacher (2018) are consistent with those of related work for the UK which suggests that immigration (in

general) and property prices can be negatively correlated, or not related at all, depending on the level of aggregation one considers (Sá, 2014; Braakmann, 2016). According to these studies, negative impacts can materialize because of interactions between rental and property markets that are driven by mobility responses of natives and neighborhoods that are changed by immigration.

Most of the studies on immigration and real estate markets reviewed above focus on economic rather than forced migration (the few notable exceptions are Saiz (2003), Tumen (2016), Balkan et al. (2018), Alhawarin et al. (2018), Kjellander et al. (2018) and Lastrapes and Lebesmuehlbacher (2018)), and few study historical settings that exhibit features encountered and valued in natural experimental environments that aid identification, such as a sudden, unexpected and sizeable inflow of migrants, policy-restrictions on their regional mobility and settlement post arrival, limited return migration, and restricted endogenous selection into migration. Furthermore, regional units of analysis considered in this literature are often quite large, comprising whole metropolitan areas or entire counties. Recent evidence, however, suggests that such levels of aggregation may be too high for unearthing certain kinds of impact that immigration may have on housing markets. Assessing immediate neighborhood effects within urban areas, Saiz and Wachter (2011) and Accetturo et al. (2014) find that house price growth tends to be relatively slower in residential areas in which migrants predominantly settle than in surrounding neighborhoods that are characterized by lower migrant densities. Likewise, Balkan et al. (2018) provide evidence for potential price premia paid by natives for rental units located in native-dominated residential areas following the mass arrival of Syrian refugees to Turkey, arguing that natives' demand for residential segregation may have led to positive price effects for upper quality rental units, while lower quality dwellings seem to have been unaffected. Hence, adverse externality shocks of concentrated migrant settlement patterns may well harm rental prices and property values in immediately surrounding areas. In this context, ethnicity, differences in socioeconomic status, and the degree of cultural similarity or distance to natives may be of great importance for natives' perceptions, and changes therein, of the quality of local amenities, and thus for the local demand for residential segregation (Harris, 1999; Saiz and Wachter, 2011; Accetturo et al., 2014; Tumen, 2016; Balkan et al., 2018).

2.2 Germany and the 2015 European Refugee Crisis

Headlines on fatal boat incidents in the Mediterranean, leaving thousands of shipwrecked migrants dead, began to struck the news already from the late-2000s (BBC, 2007, 2009, 2011). However, it was not until these headlines recurred more frequently (BBC, 2015a,b,c), triggered by an exodus of migrants from the Middle East and the Islamic World which was fuelled by political instabilities, armed conflicts and state repressions (Keijzer and Schraven, 2015), that these shipwrecking events were recognized as the sign of a major crisis which gathered momentum, a crisis that soon would be referred to as "the world's largest humanitarian crisis since World War II" (ECHO, 2015). The outbreak of civil war in the Syrian Arab Republic in 2011 and ISIS's proclamation of the caliphate in the region in 2014, which resulted in a brutal war of faith (Middelhoff, 2015), induced exploding numbers of civilians to abandon their home countries, most of them destined for Europe both seaborne and overland (Faigle et al., 2016), an exodus that sparked and fuelled the 2015 European Refugee Crisis. This exodus gained momentum following a press conference on 31st August 2015 in which German chancellor Angela Merkel, faced with large numbers of displaced people persevering at the gates of Europe, declared in a famous statement that "[w]e will make it!" (*Wir schaffen das!*) (Federal Government, 2015b). Opening the German border to numerous refugees stranded in Hungary on September 4th (Blume et al., 2016), Merkel announced that there were "no limits on the number of asylum seekers" (The Irish Times, 2015) the country would admit.[6]

[6]On 24th August, Germany invoked the *'sovereignty clause'* in accordance with the *Dublin III Regulation (No. 604/2013)* for humanitarian reasons, thereby suspending the hitherto strictly enforced Dublin procedure, according to which asylum seekers had to file their asylum claims in the very country in which they first had entered the European Union. Syrian refugees that made it to

Germany suddenly found itself in an exceptional and also tenuous situation. More than 17,500 refugee arrivals to Munich central station alone were recorded in the following two days, and similar numbers, it appeared, had to be expected for weeks to come (Blume et al., 2016). As depicted in Figure 1, monthly total arrivals (asylum seekers, shown by the solid line) soared in the last four months of 2015. These mass arrivals only came to a halt when the *Balkan Route* was closed in March 2016 (European Council, 2016; BMI, 2016a,b, 2017; bpb, 2018). Notwithstanding these numbers, many Germans got active, helping those who arrived through private donations (monetary, and in kind) and voluntary work of various type (Hoesch, 2018). Many also welcomed refugees upon their arrival at train stations throughout Germany (Dewast and Chaturvedi, 2015) – gestures and signs of caring that led to the coinage of the term "culture of welcoming" (*Willkommenskultur*) to characterize the reigning spirit at the time and the positive reception of refugees by large parts of the German population, a phenomenon that received global press coverage and attention (Sueddeutsche Zeitung, 2015). It did not take much time, however, until critics and sceptics began to raise their voice, both within Germany and abroad, and anti-foreign sentiments began to spread (Hoesch, 2018). Aided by events like the Cologne New Year's Eve incidents, public opinion started to change and to question ever more forcefully, whether the German open-door policy and culture of welcoming had been short-sighted and wrong (Hewitt, 2016; Scheer, 2017). (Social) Media platforms were leveraged for anti-foreigner campaigns and authorities blamed for their failure to master the administrative and logistical challenges created by the mass arrival of refugees to the country, resulting in heated debates, the stigmatization of refugee migrants, and a polarization of the general public (Erhardt, 2015; Haller, 2017).

The unexpectedness and scale of the vast migrant influx to Germany led to chaotic circumstances in late 2015 in the registration of refugees and their lodging, and also in the processing of asylum applications. This severely complicated, and in parts made impossible, the statistical recording of actual refugee inflows to different German regions at the time and the collection of high quality stock data on the end-of-year (EoY) spatial distribution of refugees in public registries, such as the *Central Register of Foreigners (Ausländerzentralregister, or AZR)*, as documented below. Asylum seekers who arrived to Germany had to report to a state organization that they were seeking asylum, either upon arrival at the German border with border authorities or immediately after their arrival with a state or public authority (e.g. the police, a branch office of the *Federal Office for Migration and Refugees (BAMF)*, or a reception facility) (BAMF, 2016c). This initial *informal registration* of the request for asylum was registered via the EASY-system (Federal Government, 2016) and asylum seekers were issued an *Asylum Seeker Registration Certificate (BüMA)*[7] (BAMF, 2016b,c), which initiated the first step of the official asylum procedure (Burger and Stoldt, 2015), entitled refugees to reside in Germany (*Aufenthaltsgestattung*) (§55(1) AsylG), and qualified them for receipt of asylum benefits in accordance with the *Act on Benefits for Asylum Seekers (AsylbLG)* and the *Asylum Act (AsylG)* (Bundestag, 2015). In our analysis, we use high-quality register data on these recipients (some of which are unique special data extracts provided to us by the sixteen statistical offices of the German federal states), drawn from the *Statistic on Asylum Seekers' Benefits*, an EoY compulsory count with full coverage of all individuals receiving any such kind of benefit in Germany.

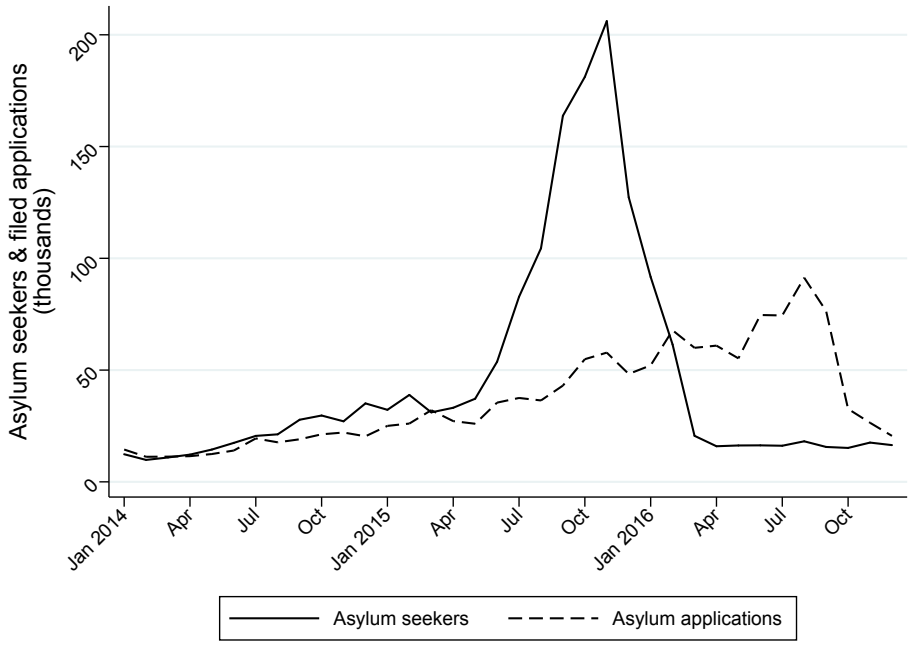
The records in the EASY-system provided the basis for the initial distribution of asylum seekers onto the federal states according to the predetermined quota defined by the Koenigstein Key (Federal Government, 2016; BAMF, 2016c).[8] However, entries in EASY at the time did not contain any personal information, which led to an initial overcount (of the stock) of new asylum seekers in EASY because multiple recordings occured when individuals registered (sequentially) in several federal states, or individuals relocated to another country, thus effectively (but unobserved)

Germany could therefore henceforth apply for asylum in Germany (ECRE, 2015).

[7]The BüMA was the primitive predecessor of the *Proof of Arrival (Ankunftsnachweis)*, which was introduced in February 2016 to record biometric information at the initial registration (BMI, 2015; BAMF, 2016b; Destatis, 2018). In the heyday of the refugee crisis, the BüMA was issued at times as a handwritten paper slip (Burger and Stoldt, 2015), and it neither included security features nor was it standardized across states (BAMF, 2016b).

[8]The acronym EASY refers to ***E**rstverteilung der **Asy**lbegehrenden*, i.e. the initial distribution of asylum seekers.

FIGURE 1: MONTHLY ARRIVALS OF ASYLUM SEEKERS AND ASYLUM APPLICATIONS IN GERMANY



NOTE: The solid line depicts the total number of monthly arrivals of asylum seekers to Germany in the period January 2014 to December 2016 as recorded by the EASY initial registry IT-system (BMI, 2016a,b, 2017; bpb, 2018), i.e. the number of informal registrations of individuals who intended to file an asylum application in Germany. The dashed line depicts the corresponding total number of actual asylum applications filed in Germany in this period, i.e. the total number of formal registrations of individuals seeking asylum in Germany (BAMF, 2015, 2016a, 2017).

ending the asylum procedure (Federal Government, 2016; Daldrup, 2016). First EASY numbers released for 2015 recorded 1,091,894 new refugee arrivals for 2015 (BAMF, 2016a). Accounting for double entries and exists, this figure was later revised to approximately 890,000 asylum seekers (BMI, 2016b). Furthermore, upon arrival at the assigned reception facility in a state, refugees in late 2015 often had to wait for weeks, because of the large numbers of arrivals and asylum applications (Burger and Stoldt, 2015), before they could formally register as asylum seekers with the BAMF (*formal registration*, i.e. AZR - registration) (Bundestag, 2016; Federal Government, 2016; Daldrup, 2016).[9] This unrecorded pent-up demand led to a substantial under-count of refugees in the EoY AZR figure for 2015 (Die Zeit, 2015; Destatis, 2018) of nearly half a million refugees (i.e. roughly every second arrival) compared to the total arrivals recorded in revised figures from the EASY-system.[10] Figure 1 documents for 2014 to 2016 monthly refugee inflows to Germany recorded in the EASY system and monthly totals of formal asylum applications filed with the BAMF.

According to the Statistic on Asylum Seekers' Benefits, which we will use in our analysis, 974,551 individuals seeking protection received asylum seeker benefits on 31st December 2015 (Destatis, 2016) in accordance with the AsylbLG and AsylG. This figure, unlike the EoY AZR count (which is but half in size), is close to the revised

[9] In the advent of the crisis, in September 2015, the number of unprocessed asylum applications already amounted to approximately 300 thousand (Hoesch, 2018).

[10] Only 476,649 individuals have filed a formal asylum application in 2015 and are hence recorded in the EoY AZR count for 2015. This figure includes mostly first applications (441,899), but also some consecutive applications (34,750) (BAMF, 2016a). A consecutive application may be filed if a previous application is withdrawn or has been rejected without right of appeal (§71AsylG).

projected number from the EASY-system cited above (approx. 890,000 asylum seeker arrivals in 2015 (BMI, 2016b)). This is due to the fact that the Statistic on Asylum Seeker Benefits counts, and contains information on, all individuals in a pending asylum procedure, including also those who did not file yet a formal application with the BAMF (unlike the AZR) but only informally reported as asylum seekers upon arrival (§1(1) no. 1 AsylbLG; §§55(1) and 63 AsylG). What is more, the EoY 2015 state-level regional distribution of asylum seekers recorded in the Statistic on Asylum Seekers' Benefits resembles fairly closely actual state-level allocation quotas based on the Koenigstein Key. As shown in Table A-1 in the appendix, this is not true for EoY AZR numbers. Because of various deficiencies in the registration and recording of formal asylum applications filed in late 2015 (Destatis, 2018), the state-level distribution recorded in AZR matches that of the Koenigstein Key only very imprecisely (differences in state quotas fluctuate between -6.13 and 2.49 percentage points, with a standard deviation of 1.96 percentage points). Relative differences in quotas (in percent) exceed 10% in 13 out of the 16 federal states and spread widely, ranging from -28.9% to 108.9%.

In 2015, refugees were obliged to reside (*Residenzpflicht*) for the first three months of the asylum procedure within a designated area (this could be a county, an administrative district or the entire federal state) depending on the allocated state (§56 AsylG; §61 AufenthG). Moreover, refugees were obliged to live for at most three months in the reception facility to which they had been allocated, an upper limit that was extended to six months with the passage of the *Act on the Acceleration of Asylum Procedures (AsylVfBeschlG)* on 24$^{\text{th}}$ Oct. 2015 (§47 AsylG).[11] If applicants were entitled to asylum (*Asylberechtigter*) (Art. 16a(1) GG), or granted refugee status (*Anerkannter Flüchtling*) (§3(1) AsylG), they received a residence permit for three years (§§25(1) or (2), 26 AufenthG), upon which they ceased to receive asylum seeker benefits but qualified for the receipt of social benefits in accordance with SGB II and SGB XII (§7(1) SGB II). If applicants received only subsidiary protection (§4(1) AsylG), were entitled to stay because of a ban preventing their deportation (§60(5) or (7) AufenthG), or their deportation was temporarily postponed (§60a AufenthG), they continued to be entitled to asylum seeker benefits if the residency title granted to them did not exceed six months (§1(2) AsylbLG). The latter restriction did not apply in cases where a temporary right to reside was issued (i.e. *Aufenthaltsgewährung*) on the basis of international law or on humanitarian grounds (§1(1) no. 3 AsylbLG; §§23(1), 24, 25(4) or (5) AufenthG).

3 Empirical Strategy and Data

3.1 Data and Setting

For our empirical analysis, we make use of two main sources of data, individual property market data from *Immobilien-Scout24*, Germany's leading online property broker[12], and regional data (partly in the form of special data extracts) on EoY refugee populations and their type of accommodation from the *Statistic on Asylum Seekers' Benefits*.

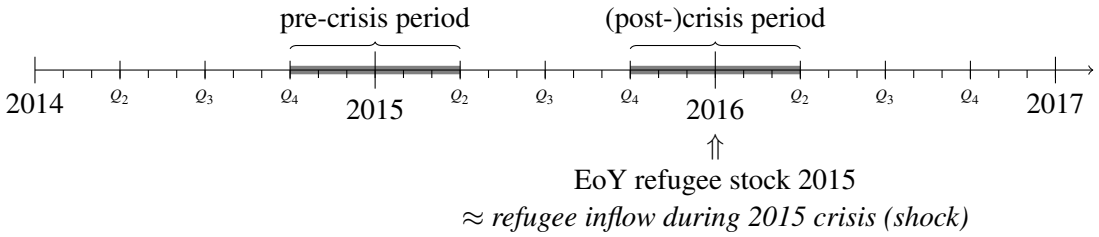
The *ImmobilienScout24* data covers the universe of monthly geo-referenced individual offers of flats for rent on the broker's website. We pool these into a pre- and (post-)crisis period, each of six months length, which we use in difference-in-differences (DiD) regressions with spatial fixed effects at a small administrative regional unit (municipality level). As illustrated in Figure 2, the pre-crisis period covers the months October 2014 to March 2015, and the (post-)crisis period the months October 2015 to March 2016. Our dependent variable is the log monthly base rent per square meter of a property offered for rent. We exclude from our estimation sample apartment listings for which information on property characteristics is missing or for which there is no other listing in its municipality in the

[11] Asylum seekers from save origin countries had to reside in their designated reception facility for the entire duration of their asylum procedure (§47 AsylG; AsylVfBeschlG).

[12] According to the *Unique Visitors* ranking of *comScore Media Metrix*, a market research institution, *ImmobilienScout24* had a market share in March 2016 of approximately 63% of the German online property market (ImmobilienScout24, 2017).

total twelve month period under investigation. We also exclude offers with very extreme characteristics.[13] Our final estimation sample consists of approximately 1.99 million monthly observations on about one million rental units. The size of our estimation sample and the rich real estate information contained in the data allow us to control for numerous and very detailed characteristics of properties in our hedonic (rental) price regressions, such as the construction year of the property, its living space [m^2], flat type and condition, floor level, and interior fittings (amongst other items). A complete list of these property-specific characteristics is provided in Table A-2 in the appendix.

FIGURE 2: TIMELINE OF SETTING, FRAMEWORK OF ANALYSIS AND DATA SAMPLING STRATEGY



Regional data on EoY refugee populations and their accommodation are drawn from the *Statistic on Asylum Seekers' Benefits*[14], a compulsory administrative records count of all asylum seekers and their location of residence on the 31st December of a year who on that day receive any kind of benefit in accordance with the *Act on Benefits for Asylum Seekers (AsylbLG)*.[15] Importantly, as documented in Section 2.2, foreigners seeking asylum in Germany are entitled to such benefits already when they enter the first stage of the asylum procedure (Bundestag, 2015; §1(1) no. 1 AsylblG and §63 AsylG). Their recording in the heyday of the 2015 refugee crisis hence does not suffer from the severe undercounting of refugees besetting the 2015 EoY count in the *Central Register of Foreigners (Ausländerzentralregister, or AZR)* which required refugees to have lodged already their formal applications for asylum. In our analysis, we use 2015 EoY counts of refugee populations in Germany's 402 counties as proxies for the county-level inflows of refugees during the crisis of 2015. We normalize these inflows by (pre-crisis) 2014 county populations. In addition, using special data extracts from the *Statistic on Asylum Seekers' Benefits*, we construct controls for the prevalence of different types of refugee accommodation at county, respectively municipality level. At the level of counties, we consider for this purpose the share of refugees that is housed in decentralized, as opposed to centralized accommodation.[16] At the level of municipalities, we consider in addition indicators for the presence of different types of centralized accommodation facilities, i.e. reception centers and group quarters.

Using county-level administrative maps of Germany, Figure 3 illustrates graphically regional differences in *year on year (YoY)* changes in rental price indices (between the fourth quarters of 2014 and 2015, and the first quarters of 2015 and 2016)[17], refugee inflows in 2015 normalized by 2014 county populations (our shock measure), and 2015 EoY

[13] We exclude flats with a listed rent per square meter below 1 Euro or above 100 Euro, flats with a living space below 6 and above 500 square meters, flats for which the number of rooms exceeds 10 or is less than 1, flats which are aged 200 years or more, and flats that are still under construction with an expected duration until completion that exceeds two years. We also exclude flats with more than 5 bathrooms, flats that are located above the 87th floor or below the lower ground floor, and flats that are dilapidated.

[14] The German Federal Statistical Office signs responsible for the design and organization of the count for the *Statistic on Asylum Seekers' Benefits*, but the actual count is carried out by the statistical offices of the 16 federal states in Germany (Destatis, 2016).

[15] Benefits are mainly in kind, such as housing, food, or medical services, but can also take the form of small financial allowances.

[16] Centralized accommodation includes refugee reception centers and other shared accommodation facilities (i.e. group quarters), decentralized accommodation non-shared dwellings, in particular individual flats provided by the responsible authorities (Destatis, 2016).

[17] These indices were calculated using data from *ImmobilienScout24* for the years 2007 to 2016.

FIGURE 3: REGIONAL VARIATION IN RENT GROWTH, REFUGEE INFLOWS AND REFUGEE HOUSING

NOTE: The two maps in the top panel show the year-on-year (YoY) change in rental price indices at county level between the fourth quarters of 2014 and 2015 (top left map), respectively the first quarters of 2015 and 2016 (top right map). The two maps in the lower panel show the EoY refugee stock in 2015 normalized by the 2014 population (bottom left map) and the 2015 EoY refugee share in decentralized accommodation (bottom right map). County values are grouped into quintiles and depicted by different shades of gray (darker colors indicate larger values). County-level rental price indices were calculated using the hedonic time-dummy method and the universe of rental price data from 2007 to 2016, following the methodological approach outlined in Bauer et al. (2013). The hedonic regressions were applied to stratified samples at county level, including municipality fixed effects as well as the full set of property specific characteristics used in this paper. Data used for constructing these maps come from ImmobillienScout24 (for property data) and special data extracts from the Statistic on Asylum Seekers' Benefits (for refugee data).

shares of refugees that are housed in decentralized accommodation. As is evident, areas with relatively large inflows of refugees are not necessarily characterized by comparatively large rental price increases. Furthermore, concerning EoY refugee shares in decentralized accommodation, it appears that state authorities have adopted considerably different approaches in handling the problem of refugee housing in late 2015, as indicated, for instance, by the stark difference visible between the federal states of Bavaria in the south east and neighboring Baden-Wuerttemberg in the south west of Germany.

3.2 Empirical Framework

To analyse the (short-term) effects of refugee immigration on residential rental prices, we estimate variants of the following difference-in-differences model:

$$\log rent_{ict} = \mu_m + \tau_t + X'_{ict}\beta + \eta POST_t + \delta POST_t \times \frac{ref_{c2015}}{pop_{c2014}} + \gamma POST_t \times \frac{ref\ dec_{c2015}}{ref_{c2015}} + \varepsilon_{ict}, \quad (1)$$

where $\log rent_{ict}$ is the log base rent (i.e. excluding utilities) in Euro per square meter of flat i in county c in month t. The main explanatory variables are the two interaction terms $POST_t \times \frac{ref_{c2015}}{pop_{c2014}}$ and $POST_t \times \frac{ref\ dec_{c2015}}{ref_{c2015}}$. $\frac{ref_{c2015}}{pop_{c2014}}$ measures the 2015 refugee inflow to county c (as approximated by the EoY refugee stock in 2015 and normalized by the 2014 population of county c), and $\frac{ref\ dec_{c2015}}{ref_{c2015}}$ measures the 2015 EoY share of refugees that are housed in decentralized accommodation in county c. $POST_t$ is a dummy variable for the (post-)crisis period, taking value one in the period October 2015 to March 2016, and zero otherwise.[18] The primary coefficients of interest, δ and γ, hence capture the average effect on rental prices at county level (in percent) of an increase in the EoY refugee stock in 2015 equal to one percent of the initial local population, respectively a one percentage point increase in the 2015 EoY share of refugees that are housed in decentralized accommodation.[19] All regressions include spatial (municipality) and season (month of year) fixed effects, denoted by μ_m and τ_t, and control for various characteristics of flats and their location X_{ict} (a list of these characteristics is provided in Tables A-2 and A-3 in the appendix).

To control for potential confounding influences at the neighborhood level, we also include as regressors a set of lagged neighborhood characteristics (from 2013) at the one kilometer grid level, which we obtained from the RWI-GEO-GRID (Breidenbach and Eilers, 2018; microm Consumer Marketing, 2016). These include the unemployment rate (RWI and microm, 2017c), the share of the foreign-born population (RWI and microm, 2017b), and the share of buildings that are predominantly in commercial use prior to the crisis (RWI and microm, 2017a). These covariates intend to control for location-specific migrant self-selection and/or selectivity in refugee allocations by responsible authorities that are related to respectively pre-crisis local economic conditions, neighborhoods' ethnic composition, and the structure of the local housing market. All three measures enter both in levels and as interactions with the dummy variable(s) for the (post-)crisis period to capture differential trends in neighborhood-level rental price growth which is related to these location-specific factors.[20]

Notwithstanding the favourableness of the contextual setting for identification, the use of fixed effects for small regional units, and the above-mentioned multitude of property and neighborhood characteristics considered, there is still a risk that unobservables may confound the relationships of interest between regional inflows of refugees and their accommodation and regional rental price growth, causing bias in our estimates of δ and γ. We therefore estimate also instrumental variables (IV) regressions, exploiting for identification arguably exogenous variation (conditional on our core covariates) in:

a. refugee inflows across regions that is related to intra-state distances between counties that housed refugee reception centers in 2014 (i.e. prior to the crisis) and surrounding counties.

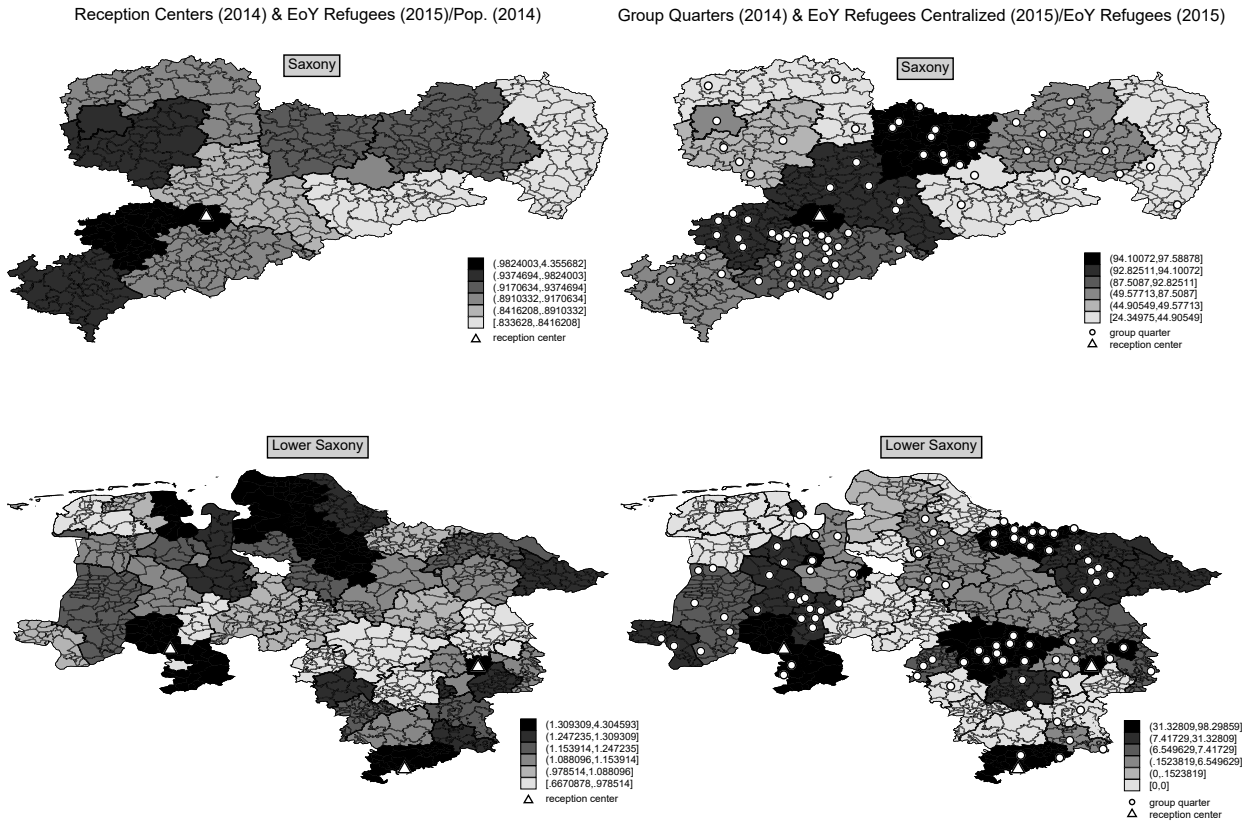
b. the share of refugees in decentralized accommodation that is related to the county-level share of municipalities which housed refugee group quarters in 2014 (i.e. again prior to the crisis).

[18] In some specifications, we split this six month treatment period into two subperiods of equal length, the last quarter in 2015 and the first quarter in 2016. This allows us to explore and compare the immediate response and the subsequent evolution of rents to the mass arrival of refugees in the heyday of the crisis in late 2015, of which we take stock on 31st December 2015.

[19] In additional explorations, we also used alternative main explanatory variables (the percentage-point changes between 2014 and 2015 in the EoY refugee stock and in the EoY refugee share in decentralized accommodation) to study the effects of *non-standard exposure* of counties during the 2015 refugee crisis on rental prices. Results from these regressions produced qualitatively identical results.

[20] Summary statistics for the lagged neighborhood characteristics at the one kilometer grid level are provided in Table A-3 in the appendix.

FIGURE 4: IV APPROACH - GRAPHICAL ILLUSTRATION FOR THE STATES OF SAXONY AND LOWER SAXONY



NOTE: The two maps in the top panel illustrate the IV approach for the state of Saxony (in former East Germany), the two maps in the bottom panel for the state of Lower Saxony (in former West Germany). County values of the two (potentially endogenous) main explanatory variables, $\frac{ref_{c2015}}{pop_{c2014}}$ and $\frac{ref\ dec_{c2015}}{ref_{c2015}}$, are grouped into quintiles and depicted by different shades of gray (darker colors indicate larger values of county-level refugee inflows, respectively, larger shares of refugees in centralized accommodation). White triangles depict approximate (municipality-level) locations of refugee reception centers in 2014, and white dots illustrate the locations of municipalities that housed group quarters other than reception facilities in 2014. Data used for constructing these maps come from special data extracts from the Statistic on Asylum Seekers' Benefits.

These IVs exploit the pre-crisis locational structure of publicly-run refugee group quarters and related (pre-determined) allocation mechanisms of state and sub-state authorities governing the regional distribution of refugees of importance for the routes refugees were to take along the stages of their asylum procedure in the later part of 2015 – a time where authorities found themselves surprised and confronted with large-scale refugee arrivals for which they had to organize at short notice sufficient accommodation. As described in Section 2.2, upon arrival to Germany refugees were allocated first across the 16 federal states according to the Koenigstein Key, which is calculated annually based on tax and population figures from the last two years (GWK, 2017; German Federal Social Insurance Authority, 2016), and thereafter to one of the designated state's reception centers from which they could, after a maximum residency of three months (six months after the passage of the AsylVfBeschlG on 24th October 2015), be distributed by state and sub-state authorities onto other group quarters within the state or be housed in decentralized accommodation. As existing capacities of reception centers in late 2015 became in most instances rapidly exhausted, emergency shelters and affiliated reception facilities had to be opened at short notice and in large numbers (Federal Government, 2015a). These additional facilities often opened in the vicinity of 'core' reception centers that had existed already in 2014,

which permitted their incorporation into and utilization of the pre-crisis infrastructure for the allocation of refugees and the processing of their asylum applications in accordance with the set-out stages of the asylum procedure. For the same reasons, counties with a comparatively large share of municipalities housing refugee group quarters in 2014 have often resorted first and heavily to such facilities when large numbers of refugee arrivals required immediate and sufficient housing capacity. Figure 4 depicts an exemplary graphical illustration of the IV approach for the federal states of Saxony and Lower Saxony. For identification, our IV strategy requires that (conditional on controls) both the average intra-state distance between *'reception counties'* and surrounding counties as well as the county-level concentration of *'group quarter municipalities'* in 2014 affect rental prices in the (post-)crisis period (Q4:2015 - Q1:2016) only via their influence on regional refugee inflows and the share of refugees in decentralized accommodation in late 2015. There must also be no unobserved factor that drives both our instruments and rental price growth. We construct our IVs, the average intra-state proximity between reception counties and surrounding counties and the county-level concentration of group quarter municipalities in 2014 using special data extracts from the Statistic on Asylum Seekers' Benefits (for both IVs) and driving distances (in kilometers) between 'reception counties' and surrounding counties using geo-referenced county-level population centers (for the first IV).[21] Using these distance measures, for each county c, the inverse of the log average intra-state distance to all surrounding 'reception counties', denoted by $proximity_{c,reception\ county\ 2014}$, is defined as:

$$proximity_{c,reception\ county\ 2014} = \frac{1}{1+\log(1+average\ distance_{c,reception\ county\ 2014})} \quad . \tag{2}$$

The county-level share of municipalities housing at least one group quarter in 2014, $share_{c,group\ quarter\ 2014}$, in turn, is defined as:

$$share_{c,group\ quarter\ 2014} = \frac{\#\ municipalities_{c,group\ quarter\ 2014}}{total\ \#\ municipalities_{c,2014}} \quad . \tag{3}$$

Each county-level instrument is statistically significantly correlated with the (potentially endogenous) regressor for which it is used, i.e. the refugee inflow at county level $\frac{ref_{c2015}}{pop_{c2014}}$, respectively the share of refugees that in late 2015 are living in decentralized accommodation $\frac{ref\ dec_{c2015}}{ref_{c2015}}$. The relevant correlation coefficients (at county-level) are $corr\left(\frac{ref_{c2015}}{pop_{c2014}}, proximity_{c,reception\ county\ 2014}\right) = 0.39 \quad (p-value: 0.0000)$ and $corr\left(\frac{ref\ dec_{c2015}}{ref_{c2015}}, share_{c,group\ quarter\ 2014}\right) = -0.54 \quad (p-value: 0.0000)$.

4 Results

4.1 Main Results

We start by estimating two versions of a simplified variant of the difference-in-differences model specified in Eq. (1), in which we disregard refugee accommodation structure and is effects and consider only the impact of the (size) of the county-level refugee inflow on rent price growth. In both models, we control for regional (municipality) and season (month of year) fixed effects, as well as as various characteristics of flats and their location (for a list of these characteristics, see Tables A-2 and A-3 in the appendix). The first considers the entire six month period October 2015 to March 2016 as the (post-)crisis treatment period, the second splits that period into two subperiods of equal length, the last quarter in 2015 and the first quarter in 2016 (see column (1) in Table 1). As motivated in Section 3.2,

[21] 'Reception counties' and 'group quarter municipalities' denote administrative regions that house at least one reception center or group quarter in 2014, i.e. prior to the crisis. We calculate driving distances using the Stata module *osrmtime* (Huber and Rust, 2016).

this split permits us to explore and compare the immediate response and subsequent evolution of rents to the mass arrival of refugees in the heyday of the crisis in late 2015, of which we take stock on 31st December 2015. For better legibility, we report only estimated coefficients of treatment period indicators and estimated treatment effects for the scale of county-level refugee inflows, i.e. the coefficients on interactions of these period indicators with the 2015 refugee inflow to a county (as approximated by the EoY refugee stock in 2015 and normalized by the 2014 population of the county).[22] As can be seen, refugee immigration in 2015 exerted a sizeable adverse effect on rental prices. A one percent increase in the 2015 EoY refugee stock (normalized by 2014 county population) is associated with 0.68% lower year-on-year average rental price growth in the period October 2015 to March 2016.[23] Furthermore, this adverse effect is nearly twice as large in the latter half of this period (first quarter of 2016) than in the first (last quarter of 2015).

TABLE 1: OLS REGRESSION RESULTS FOR IMPACT OF REFUGEE IMMIGRATION AND REFUGEE ACCOMMODATION ON RENT PRICE GROWTH

	Dependent Variable: $\log(rent/m^2)$							
	(1)		(2)		(3)		(4)	
Treatment Periods:								
$Oct_{2015} - Mar_{2016}$	0.0434***		0.0480***		0.0378***		0.0408***	
	(0.0043)		(0.0059)		(0.0050)		(0.0063)	
$Oct_{2015} - Dec_{2015}$		0.0357***		0.0392***		0.0310***		0.0333***
		(0.0042)		(0.0055)		(0.0051)		(0.0060)
$Jan_{2016} - Mar_{2016}$		0.0509***		0.0568***		0.0445***		0.0484***
		(0.0045)		(0.0064)		(0.0053)		(0.0068)
Treatment Effects - Refugee Immigration:								
$Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014}$	−0.6788***		−0.7667***		−0.5156**		−0.5718**	
	(0.2094)		(0.2271)		(0.2104)		(0.2306)	
$Oct_{2015} - Dec_{2015} \times ref_{c2015}/pop_{c2014}$		−0.4732**		−0.5398**		−0.3396*		−0.3827*
		(0.1972)		(0.2097)		(0.1969)		(0.2123)
$Jan_{2016} - Mar_{2016} \times ref_{c2015}/pop_{c2014}$		−0.8737***		−0.9874***		−0.6800***		−0.7527***
		(0.237)		(0.2470)		(0.2262)		(0.2516)
Treatment Effects - Refugee Accommodation:								
$Oct_{2015} - Mar_{2016} \times decentr.\ share_{c2015}$			−0.0105*				−0.0061	
			(0.0058)				(0.0052)	
$Oct_{2015} - Dec_{2015} \times decentr.\ share_{c2015}$				−0.0080				−0.0047
				(0.0053)				(0.0048)
$Jan_{2016} - Mar_{2016} \times decentr.\ share_{c2015}$				−0.0134**				−0.0077
				(0.0064)				(0.0060)
Municipality fixed effects	Yes		Yes		Yes		Yes	
Seasonal effects	Yes		Yes		Yes		Yes	
Flat-specific characteristics	Yes		Yes		Yes		Yes	
Lagged neighborhood characteristics (1km grid)	No		No		Yes		Yes	
Observations	1,986,303		1,983,480		1,985,590		1,982,767	

NOTES: The endogenous variable is the log of the base rent per square meter posted. For a list of the flat-specific characteristics considered, see Table A-2 in the appendix. Lagged neighborhood characteristics (from 2013) at 1km grid level include the unemployment rate, the share of the foreign-born population, and the share of buildings that are predominantly in commercial use prior to the crisis. The number of municipality fixed effects is 7,192 in specification (1), 7,176 in specification (2), 7,187 in specification (3) and 7,171 in specification (4). Standard errors are clustered at the county level. ***, **, * denote statistical significance at the 1%, 5% and 10% level.

We next add our second key explanatory variable to this simplified variant of our difference-in-differences model, the 2015 EoY share of refugees that are housed in decentralized accommodation in a county, interacted again one time with our (post-)crisis treatment period indicator for the entire six month period October 2015 to March 2016, and one time with our two indicators for the last quarter in 2015 and the first quarter in 2016 (see column (2) in Table 1). The coefficient estimates on the treatment effects for the normalized 2015 EoY refugee stock remain negatively signed and statistically significant (they even increase somewhat in absolute magnitude), both for the six month (post-)crisis period October 2015 to March 2016 and its respective halves (the last quarter in 2015 and the first quarter in 2016). What is more, a higher county-level 2015 EoY share of refugees housed in decentralized accommodation also appears to harm rental price growth. Estimated treatment effects are all negatively signed and also statistically significant for the period October 2015 to March 2016 and the first quarter of 2016 (but not the last quarter of 2015). For the first quarter of 2016, a one percentage point increase in the county-level 2015 EoY share of refugees in decentralized

[22] Full tabulated regression output for all tables in this study can be obtained from the authors upon request.

[23] The mean county-level 2015 EoY refugee stock (normalized by 2014 county population) is 1.2% (standard deviation 0.74%).

housing is associated with 0.013% lower year-on-year average rental price growth.[24]

Finally, we add controls for lagged neighborhood characteristics (from 2013) measured at 1km grid level. Column (3) reports estimated period and treatment effects of county-level refugee inflows on rent price growth, and column (4) in addition also estimated treatment effects of county-level refugee accommodation. In both cases, and for all three treatment periods considered (October 2015 to March 2016, last quarter of 2015, and first quarter of 2016), refugee immigration continues to harm year-on-year rent price growth, albeit now somewhat less strongly. Furthermore, adverse effects are still largest in magnitude in the first quarter of 2016. Treatment effects for the scale of decentralized refugee accommodation are also (and still) negatively signed, but now lack statistical significance.[25]

Summarizing the above, our first analyses point to sizeable adverse effects of refugee inflows on rental prices. There also seems to be some evidence, albeit more tentative, that higher rates of decentralized accommodation tend to work in the same direction; this does not hold true, however, if one controls at fine spatial grid levels for lagged socio-economic characteristics of neighborhoods. What explains such harmful effects of refugee inflows? One explanation, and a prime potential causal pathway, is that property prices may take harm if natives perceive local settlements of refugees as a disamenity. If indeed the case, rent prices of property located closer to refugees and refugee accommodation facilities within a county should be harmed more. In the following, we explore such potential effect heterogeneity of county-level variations in refugee inflows by within-county location of property.

For this purpose, we make use of triple interactions that capture differences in our standard treatment effect for refugee immigration by type of municipality in which a property is located. We ignore for this exercise our county-level measure of refugee accommodation and focus exclusively on the (post-)crisis treatment period which spans the entire six months from October 2015 to March 2016. We consider altogether $k = 5$ triple interactions of the form $Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014} \times municip^{k}_{2015}$ that differ only in the binaries $municip^{k}_{2015}$. These binaries capture whether the municipality in which a property is located houses at the end of 2015 any refugees, any type of group quarter facility, reception centers, other group quarters, or both reception centers and other group quarter facilities.[26] To ease interpretation of these triple interactions, we center their continuous component $\frac{ref_{c2015}}{pop_{c2014}}$ at its mean. Positive (negative) values of this demeaned term hence indicate 'above' ('below') average county-level exposure to refugee immigration in 2015. We estimate three different specifications, whose results are shown in Table 2. The first specification only considers the triple interaction for the presence of refugees in a municipality at the end of 2015 (see column (1)), the second adds the triple interaction for any kind of group quarter in a municipality (column (2), and the third replaces the triple interaction for any kind of group quarter with the three triple interactions for receptions centers, other group quarters, and the presence of both reception centers and other group quarter facilities in a municipality (column (3)). Note that in each specification, we add to our set of regressors also the corresponding double interaction(s) $Oct_{2015} - Mar_{2016} \times municip^{k}_{2015}$. Estimated coefficients on our triple interactions hence capture the differential impact on the rental price of property in municipalities housing refugees (or different types of group quarter facilities) in 2015 that belong to counties which have been subject to 'above' average county-level refugee immigration in 2015. For all specifications, the base category are flats offered for rent in the pre-crisis period which are located in municipalities that housed no refugees at the end of 2015 and which belong to counties with average refugee immigration in 2015, as approximated by the EoY refugee stock in 2015 which we normalize by the 2014 county population. As can be seen from Table 2, rental price growth in this base group amounts to about 3.3%.

As shown in column (1), flats located in municipalities that housed no refugees at the end of 2015 but lie in counties with an 'above' average county-level exposure to refugee immigration do not differ in their average rental price growth

[24]The mean county-level 2015 EoY share of refugees in decentralized housing is 50% (standard deviation 35.17%).

[25]Note that this lack of significance is not driven by inflated standard errors (they roughly remain the same), but by estimated coefficients that declined by nearly half their value in size.

[26]For constructing these municipality-level indicators on the within-county regional dispersion of refugees and group quarter facilities of different type, we use information from special data extracts drawn from the Statistic on Asylum Seekers' Benefits.

TABLE 2: OLS REGRESSION RESULTS FOR IMPACT OF REFUGEE IMMIGRATION ON RENT PRICE GROWTH BY EXPOSURE OF MUNICIPALITIES TO REFUGEES AND GROUP QUARTERS IN 2015

	Dependent Variable: $\log(rent/m^2)$		
	(1)	(2)	(3)
Treatment Periods:			
$Oct_{2015} - Mar_{2016}$	0.0329^{***}	0.0327^{***}	0.0325^{***}
	(0.0060)	(0.0060)	(0.0060)
Treatment Effects - Refugee Immigration (above mean):			
$Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014}$	0.4472	0.4473	0.4496
	(0.3641)	(0.3641)	(0.3627)
Rent Price Growth by Type of Municipality:			
$Oct_{2015} - Mar_{2016} \times municip_{2015}^{refugees}$	-0.0015	0.0049	0.0043
	(0.0062)	(0.0057)	(0.0057)
$Oct_{2015} - Mar_{2016} \times municip_{2015}^{any\,group\,quarter}$		-0.0069^{*}	
		(0.0040)	
$Oct_{2015} - Mar_{2016} \times municip_{2015}^{reception\,center}$			-0.0173^{***}
			(0.0064)
$Oct_{2015} - Mar_{2016} \times municip_{2015}^{other\,group\,quarter}$			-0.0006
			(0.0052)
$Oct_{2015} - Mar_{2016} \times municip_{2015}^{reception\,center+other\,group\,quarter}$			0.0083
			(0.0059)
Treatment Effects - Refugee Immigration (above mean) by Type of Municipality:			
$Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014} \times municip_{2015}^{refugees}$	-1.0111^{**}	0.9048	0.9285
	(0.4070)	(0.8523)	(0.8509)
$Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014} \times municip_{2015}^{any\,group\,quarter}$		-1.9426^{**}	
		(0.8885)	
$Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014} \times municip_{2015}^{reception\,center}$			-2.0146^{*}
			(1.1833)
$Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014} \times municip_{2015}^{other\,group\,quarter}$			-1.5954
			(1.0031)
$Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014} \times municip_{2015}^{reception\,center+other\,group\,quarter}$			1.8807
			(1.3003)
Municipality fixed effects	Yes	Yes	Yes
Seasonal effects	Yes	Yes	Yes
Flat-specific characteristics	Yes	Yes	Yes
Lagged neighborhood characteristics (1km grid)	Yes	Yes	Yes
Observations	1,985,590	1,985,590	1,985,590

NOTES: The endogenous variable is the log of the base rent per square meter posted. For a list of the flat-specific characteristics considered, see Table A-2 in the appendix. Lagged neighborhood characteristics (from 2013) at 1km grid level include the unemployment rate, the share of the foreign-born population, and the share of buildings that are predominantly in commercial use prior to the crisis. The continuous variable $\frac{ref_{c2015}}{pop_{c2014}}$ is centered at its mean. Municipality-level indicator variables are equal to one if a municipality housed refugees, respectively (particular types of) group quarters, in 2015. The base category in all three specifications are flats offered for rent in the pre-crisis period which are located in municipalities that housed no refugees at the end of 2015 and which belong to counties with average refugee immigration in 2015 ($\approx 1.2\%$), as approximated by the EoY refugee stock in 2015 which we normalize by the 2014 county population. The number of observations in municipalities that in 2015 house refugees is 1,949,402, that house any type of group quarter is 1,772,473, and that house reception centers is 1,093,619. Furthermore, there are 1,723,702 observations in municipalities that have other group quarters in 2015, and 1,044,848 observations in municipalities that have both reception centers and other group quarters. The number of municipality fixed effects is 7,187. Standard errors are clustered at the county level. ***, **, * denote statistical significance at the 1%, 5% level and 10% level.

from that exhibited by this base group, and neither does property in municipalities housing refugees in 2015 that lie in counties experiencing only average county-level exposure to refugee immigration. Property in municipalities that do house refugees in 2015 and that are also exposed to above average county-level refugee immigration in 2015, however, exhibit sizeably lower and statistically significant growth in rental prices than does property in municipalities with refugees in 2015 that experienced only average county-level inflows of refugees in 2015. County-level refugee immigration one percentage point above average causes rental price growth in such municipalities to fall short by 1.1611%[27] of the growth experienced by similar flats in municipalities that do not house any refugees in 2015 and that witness comparable levels of county-level exposure to refugee immigration.

Results reported in columns (2) and (3) of Table 2 show that such effect heterogeneity of county-level refugee immigration by exposure of municipalities to refugees is entirely driven by the presence of group quarters in municipalities (see column (2)), and among such municipalities entirely by those that house reception centers (column (3)). The latter, in fact, witness lower average rental price growth even when their county receives just average refugee

[27]The growth differential 1.1611% is given by the sum of the estimated coefficients on the respective double ($\times 100$) and triple interactions, i.e. -0.0015 and -1.0111.

inflows in 2015. Taken together, these findings are consistent with, and provide support for, our reading of the evidence reported in Table 1 that the sizeable adverse effects of county-level refugee immigration on rental price growth we detected can be explained by the fact that natives perceive the local presence of refugees ('in the backyard') as a disamenity, particularly when concentrated, a disamenity which is priced into housing rents.

Returning to our regression analysis in Table 1, and concerning identification more generally, controlling for neighborhood characteristics at 1km grid level, spatial fixed effects at small administrative level, a multitude of property characteristics, and seasonal fixed effects may still be insufficient for a causal interpretation of our estimated treatment effects of refugee inflows and refugee accommodation on rent prices. Systematic, but unobserved and uncontrolled for, selection of refugees into certain counties (and types of accommodation) by state authorities or refugees themselves may confound the relationships of interest and potentially bias our OLS regression results. To address this issue, we estimate, for the entire six month (post-)crisis period October 2015 to March 2016, instrumental variables (IV) regressions, exploiting for identification arguably exogenous (conditional on our covariates) variation in refugee inflows across counties related to intra-state distances between counties that housed refugee reception centers in 2014 and surrounding counties that did not, as well as variation in the share of refugees in decentralized housing related to the 2014 spread of refugee group quarters across municipalities within counties (see Section 3.2 for the motivation and a discussion of these instruments). The results are reported in Table 3.

Model specifications considered are analogous to those used in Table 1 for the (post-)crisis period October 2015 to March 2016. Columns (1) and (2) of Table 3 report results for specifications that do not use lagged neighborhood-level controls (as of 2013) at the 1km grid level, while columns (3) and (4) report results for specifications that do make use of such information. Furthermore, the specifications in columns (1) and (3) focus exclusively on the scale of refugee immigration, while those in columns (2) and (4) consider also type of refugee accommodation. First stage results are provided in the lower panel of Table 3. As can be seen, our two instruments prove strong. Consistent with expectations, they are highly correlated (in all specifications) with the two (potentially endogenous) main explanatory variables, and associated F-test statistics for the excluded instruments are large. What is more, the signs of these correlations are as expected too. Our first instrument, the inverse of the average intra-state distance (i.e. proximity) between reception counties and surrounding counties, is positively correlated both with the scale of county-level refugee immigration in 2015 and the 2015 EoY share of refugees that are housed in decentralized accommodation; and our second instrument, the 2014 county-level concentration of group quarter municipalities in 2014 correlates positively with the first of our two key explanatory variables, and negatively with the second. Second-stage results, reported in the upper panel of Table 3, largely confirm our OLS results for these four specifications (see Table 1), with one notable exception. Qualitatively identical, i.e. of the same sign, and also statistically significant throughout, estimated treatment effects for the size of county-level refugee immigration in 2015 are now considerably larger though. In the most fully-fledged model with both treatment effects and lagged socio-economic neighborhood characteristics (from 2013) at 1km grid level (see column (4) in Table 3), a one percent higher 2015 EoY refugee stock (normalized by 2014 county population) is associated with 0.91% lower year-on-year average rental price growth in the period October 2015 to March 2016 (a nearly 60% increase in magnitude on our OLS treatment effect estimate of 0.57%). Estimated treatment effects for the 2015 EoY share of refugees that are housed decentrally, in turn, are now statistically significant in both specifications (2) and (3) when estimated by IV, still of negative sign in specification (2), but positive in the fully fledged model reported in column (4) which considers both treatment effects and controls for lagged socio-economic neighborhood characteristics at 1km grid level (the notable exception alluded to above). Negatively signed throughout when estimated by OLS (but insignificant in the most fully fledged model) and negative also in IV estimations of specifications without lagged socio-economic neighborhood characteristics, decentralized refugee accommodation exerts a positive and statistically significant effect on rent price growth if such neighborhood heterogeneity is controlled for. Housing refugees in decentralized accommodation (as opposed to group quarter accommodation) therefore attenuates the ad-

TABLE 3: IV REGRESSION RESULTS FOR IMPACT OF REFUGEE IMMIGRATION AND REFUGEE ACCOMMODATION ON RENT PRICE GROWTH

Second Stage:	Dependent Variable: $\log(rent/m^2)$			
	(1)	(2)	(3)	(4)
Treatment Periods:				
$Oct_{2015} - Mar_{2016}$	0.0506^{***} (0.0014)	0.0544^{***} (0.0016)	0.0426^{***} (0.0051)	0.0410^{***} (0.0018)
Treatment Effects - Refugee Immigration:				
$Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014}$	-1.2629^{***} (0.1143)	-1.2646^{***} (0.1144)	-0.9143^{***} (0.1110)	-0.9121^{***} (0.1111)
Treatment Effects - Refugee Accommodation:				
$Oct_{2015} - Mar_{2016} \times decentr.\ share_{c2015}$		-0.0110^{***} (0.0018)		0.0039^{**} (0.0019)
First Stage:	Dep. Variable: $Oct_{2015} - Mar_{2016} \times ref_{c2015}/pop_{c2014}$			
$Oct_{2015} - Mar_{2016} \times proximity_{c,reception\ county\ 2014}$	0.0010^{***} [315.27]	0.0099^{***} [304.80]	0.0099^{***} [318.65]	0.0096^{***} [306.78]
$Oct_{2015} - Mar_{2016} \times share_{c,group\ quarter\ 2014}$		0.0002^{***} [15.05]		0.0009^{***} [75.56]
F-excluded instruments	99,397.95	53,141.43	$1.0e+05$	55,392.87
	Dep. Variable: $Oct_{2015} - Mar_{2016} \times decentr.\ share_{c2015}$			
$Oct_{2015} - Mar_{2016} \times proximity_{c,reception\ county\ 2014}$		0.1023^{***} [183.47]		0.1003^{***} [180.72]
$Oct_{2015} - Mar_{2016} \times share_{c,group\ quarter\ 2014}$		-0.3725^{***} [−557.27]		-0.3756^{***} [−552.38]
F-excluded instruments		$1.6e+05$		$1.5e+05$
Municipality fixed effects	Yes	Yes	Yes	Yes
Seasonal effects	Yes	Yes	Yes	Yes
Flat-specific characteristics	Yes	Yes	Yes	Yes
Lagged neighborhood characteristics (1km grid)	No	No	Yes	Yes
Observations	1,986,303	1,983,480	1,985,590	1,982,767

NOTES: The endogenous variable is the log of the base rent per square meter posted. For a list of the flat-specific characteristics considered, see Table A-2 in the appendix. Lagged neighborhood characteristics (from 2013) at 1km grid level include the unemployment rate, the share of the foreign-born population, and the share of buildings that are predominantly in commercial use prior to the crisis. The number of municipality fixed effects is 7,192 in specification (1), 7,176 in specification (2), 7,187 in specification (3), and 7,171 in specification (4). First stage t-statistics are reported in square brackets. Second stage robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% level.

verse effects on rent price growth of county-level refugee immigration.[28] This finding may be explained by either, or both, of the two primary channels through which local immigration may impact local rents (see discussion in Section 1). First, immigration-driven increases in the demand for privately-occupied property that cause upward pressure on rents will be larger, the higher is the demand for decentralized refugee accommodation. Second, natives may perceive local settlements of immigrants as less of a disamenity and hence less harmful for prices of property if such settlements are not concentrated in group quarters, but refugees instead are housed decentrally, i.e. are more dispersed locally. The importance of local neighborhood characteristics for the size, and in part also the sign, of estimated treatment effects suggests that property location (at very small spatial level) is vital for the response of property prices to immigration. The great importance of locality for real estate value has long been recognized and finds vivid expression in the saying

[28]Results reported and discussed in Section 4.2 for the last quarter of 2015 and the first quarter of 2016 show that estimated treatment effects for the size of county-level refugee immigration in 2015 also turn out considerably larger when using IV instead of OLS and that, in the fully-fledged model with both treatment effects and lagged socio-economic neighborhood characteristics, decentralized refugee accommodation also exerts (albeit only in the last quarter of 2015) a positive and statistically significant effect on rent price growth. See column (4) in Table 4 and the associated discussion in the main text in Section 4.2.

"location, location, location" (a saying repeated three times for emphasis) to describe the number one rule in real estate: local environment matters more than anything else for real estate prices. Our findings clearly support this view. Many studies on immigration and real estate which we reviewed in Section 2.1, however, consider only quite large regional units of analysis, such as whole metropolitan areas or entire counties, and fail to control for both municipality and neighborhood heterogeneity and their effects on individual real estate prices. Such failure may give rise to major bias.

4.2 Additional Explorations and Robustness Tests

In this section, we will provide some additional explorations and probe the robustness our IV findings in a battery of sensitivity tests. The baseline model we consider in these explorations and tests is our most elaborate specification that considers both municipality fixed effects and lagged neighborhood characteristics at the 1km grid level. For the sake of brevity, we report only the results for the two quarters October to December 2015 and January to March 2016. The results are summarized in Tables 4 and 5. As a point of reference, and to complete our previous IV analysis which considered (unlike our OLS estimation) only the entire six month period from October 2015 to March 2016, but not separately also its constituent two quarters, we first re-estimate by IV all four specifications of Table 3 for the two outcome quarters (the respective results are shown in columns (1) to (4) in Table 4). In all four specifications, estimated treatment effects for the size of county-level refugee immigration in 2015 turn out negative, statistically significant, and larger in magnitude than the corresponding OLS estimates. Furthermore, and as for the entire six month period from October 2015 to March 2016, decentralized refugee accommodation exerts a positive and statistically significant effect on rent price growth in the last quarter of 2015 (but not in the first quarter of 2016) when we control for lagged neighborhood characteristics at the 1km grid level (see column (4) in Table 4). In the following, we use this most fully-fledged model with lagged neighborhood characteristics as our baseline model that we subject to various sensitivity tests.

As a first robustness check, we change the level of spatial fixed effects that we consider from municipalities to the larger administrative regional unit of counties. As shown in columns (5) and (6) of Table 4, estimated treatment effects for both refugee immigration and refugee accommodation change little from those in our baseline IV specifications with lagged neighborhood characteristics at the 1km grid level reported in columns (3) and (4). Statistically significant estimates remain significant and of the same sign and their magnitude even increases somewhat in size.

Second, we allow year-on-year growth in first and fourth quarter rent prices to vary across counties by the rate of population growth they experienced in 2015 (see columns (7) and (8)). This sensitivity test is inspired by the concern that county-level regional refugee inflows may be correlated, positively or negatively, with underlying county-level population growth that affects rental prices. Such correlation, which would lead to bias in our estimates, may arise from systematic migrant self-selection, or selectivity in the allocation of refugees by authorities.[29] As it turns out, however, estimated treatment effects are virtually identical for the impact of refugee immigration on rental price growth. Furthermore, decentralized refugee accommodation still exerts a positive effect on YoY fourth quarter rental price growth in 2015, albeit one that is now much larger in magnitude. Notably, YoY rental price growth for the first quarter of 2016 now also appears to have benefited from decentralized accommodation of refugees in late 2015.

Third, we add interactions of our treatment period indicators with various lagged socio-economic county characteristics to control for potential differences in rental price trends across counties that may be correlated with the county-level scale of refugee immigration in 2015 and county-level differences in the housing of refugees in late 2015.

[29]Note that selective out-migration of natives from regions experiencing large refugee immigration, while a possibility, is unlikely to be of major practical importance in our setting, given the unexpectedness, and abruptness, of refugee immigration in late 2015 and the immediacy and limited length of the observation period in which we study the effects of this immigration on rental prices, i.e. the last quarter of 2015 and the first quarter of 2016.

TABLE 4: IV RESULTS (SECOND STAGE) FOR QUARTERLY OUTCOME PERIODS - ROBUSTNESS TESTS I

	Dependent Variable: $\log(rent/m^2)$									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment Periods:										
$Oct-Dec_{2015}$	0.0413***	0.0419***	0.0357***	0.0316***	0.0378***	0.0316***	0.0300***	0.0213***	0.0247***	0.0163***
	(0.0017)	(0.0020)	(0.0018)	(0.0022)	(0.0019)	(0.0023)	(0.0018)	(0.0021)	(0.0020)	(0.0026)
$Jan-Mar_{2016}$	0.0598***	0.669 ***	0.0495***	0.0505***	0.0530***	0.0516***	0.0420***	0.0363***	0.0354***	0.0330***
	(0.0017)	(0.0019)	(0.0018)	(0.0022)	(0.0019)	(0.0023)	(0.0017)	(0.0021)	(0.0020)	(0.0026)
Treatment Effects - Refugee Immigration:										
$Oct-Dec_{2015} \times ref_{c2015}/pop_{c2014}$	−0.9245***	−0.9033***	−0.7274***	−0.7107***	−0.8288***	−0.8082***	−0.9660***	−0.9607***	−0.8242***	−0.7370***
	(0.1387)	(0.1390)	(0.1347)	(0.1352)	(0.1402)	(0.1408)	(0.1412)	(0.1413)	(0.1121)	(0.1169)
$Jan-Mar_{2016} \times ref_{c2015}/pop_{c2014}$	−1.5962***	−1.6227***	−1.0978***	−1.1116***	−1.3122***	−1.3205***	−1.3966***	−1.4070***	−1.4572***	−1.4405***
	(0.1335)	(0.1338)	(0.1296)	(0.1301)	(0.1346)	(0.1353)	(0.1358)	(0.1360)	(0.1060)	(0.1106)
Treatment Effects - Refugee Accommodation:										
$Oct-Dec_{2015} \times decentr.\ share_{c2015}$		−0.0028		0.0097***		0.0150***		0.0215***		0.0173***
		(0.0023)		(0.0024)		(0.0027)		(0.0023)		(0.0029)
$Jan-Mar_{2016} \times decentr.\ share_{c2015}$		−0.0197***		−0.0022		0.0036		0.0142***		0.0052*
		(0.0023)		(0.0025)		(0.0027)		(0.0023)		(0.0029)
$Oct-Dec_{2015} \times pop.\ growth_{c2014-15}$							0.6264***	0.6441***		
							(0.0485)	(0.0486)		
$Jan-Mar_{2016} \times pop.\ growth_{c2014-15}$							0.8137***	0.8340***		
							(0.0490)	(0.0492)		
Regional fixed effects	municipality		municipality		county		municipality		municipality	
Seasonal effects	Yes		Yes		Yes		Yes		Yes	
Flat-specific characteristics	Yes		Yes		Yes		Yes		Yes	
Lagged neighborhood characteristics (1km grid)	No		Yes		Yes		Yes		Yes	
Lagged county characteristics	No		No		No		No		Yes	
Observations	1,986,303	1,983,480	1,985,590	1,982,767	1,985,590	1,982,767	1,985,590	1,982,767	1,985,590	1,982,767

NOTES: The endogenous variable is the log of the base rent per square meter posted. First stage regression results are omitted. For a list of the flat-specific characteristics considered, see Table A-2 in the appendix. Lagged neighborhood characteristics (from 2013) at 1km grid level include the unemployment rate, the share of the foreign-born population, and the share of buildings that are predominantly in commercial use prior to the crisis. Lagged county characteristics include county-level GDP per capita in 2013, the county-level crime rate in 2013, annual per capita guest arrivals (business and non-business-related) in a county in 2013, annual per capita building permits issued for flats in 2013, and the county-level vacancy rate in 2011. To ease comparison, columns (1)-(4) reproduce the individual quarter effects corresponding to specifications (1)-(4) of Table 3. The number of fixed effects is 7,192 in column (1), 7,176 in column (2), 7,187 in columns (3), (7) and (9), 7,171 in columns (4), (8) and (10), 402 in column (5) and 400 in column (6). Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% level.

Lagged county characteristics we consider include county-level GDP per capita in 2013, the county-level crime rate in 2013, annual per capita guest arrivals (business and non-business-related) in a county in 2013, annual per capita building permits issued for flats in 2013, and the county-level vacancy rate in 2011. The lagged county-level crime rate and tourism statistic are catch-all variables for county (dis-)amenities pre treatment.[30] Lagged building permits and vacancy rates, in turn, capture regional differences in pre-treatment housing market conditions, housing market activity, and housing market prospects. As shown in columns (9) and (10) of Table 4, our estimated treatment effects for refugee immigration in 2015 remain negative and significant and those for decentralized refugee accommodation in late 2015 on YoY fourth quarter and also first quarter growth are again positive and statistically significant.

Fourth, we check whether the effects on rental price growth of refugee immigration and type of refugee housing are more pronounced for newly posted flats for rent and for flats immediately prior to their exit from the platform.[31] For this purpose, we trim our sample to include either new offers only (see columns (3) and (4) in Table 5), or exclusively last offers (columns (5) and (6)). To ease comparison, columns (1) and (2) of Table 5 again report our baseline estimates from columns (3) and (4) in Table 3. New offers, i.e. first monthly observations that dwellings are posted for rent, capture changes in the supply of rental units that stem from new postings. Similarly, last offers or postings before an ad was taken off the platform capture changes in the supply of rental units that stem from exists of offers from the market, in all likelihood because a flat has been contracted out. Last offer rents observed just before property is taken off the platform therefore arguably match actual contract rents more closely than new offer rents or rents for flats in the entire stock of dwellings offered for rent in a given month.[32] Note also that our use of online offer price data is particularly advantageous for analysing immediate price responses on real estate markets, as studied, at least in part, in the current analysis (i.e. 2015 fourth quarter rental price growth), for such data should reflect changes in local amenities more quickly than (administrative records or other recording of) transaction price data.[33] Our estimated treatment effects, reported in columns (3) to (6) of Table 5, reveal that YoY growth in rental prices of both new and last offers was slowed by county-level refugee immigration in both the last quarter of 2015 and the first quarter of 2016, but that such slowdown was stronger in the first quarter of 2016 for both type of offers than for all posted dwellings considered in our baseline analysis, and weaker (stronger) in the last quarter of 2015 for new offers (last offers) than for all offers. A higher share of refugees in decentralized accommodation in late 2015, in turn, is associated with higher YoY rental price growth in both outcome quarters and for both types of offers, rises in price growth that exceed in magnitude corresponding estimates from our baseline analysis (the estimate for last offers in the first quarter of 2016, however, is estimated only imprecisely). Taken together, the above results show that new offers and last offers (i.e. changes in the supply of offers at the extensive margin) responded more strongly to refugee immigration and type of refugee housing in the first quarter of 2016.[34] Changes in public sentiment between

[30] Related studies, such as Saiz (2007) and Gonzalez and Ortega (2013), also routinely consider time-invariant location-specific factors for the same purpose, albeit different ones, such as weather and other local amenities.

[31] Note that in previous regressions (and also in the following), we always control for potential changes in type of property offered for rent by making use of an extensive set of hedonic apartment-specific characteristics that goes well beyond standard items considered in the literature. The use of this set of covariates controls for price effects of potential changes in the composition of real estate supplied on the market in late 2015 and early 2016 that are caused by, or correlated with, refugee immigration in 2015.

[32] Differences between offer rents and contracted rents certainly may prevail. However, rental prices offered are rarely subject to negotiation between landlord and prospective tenant, unlike prices for property that is for sale.

[33] Note that landlords may modify at any time offer rents for dwellings already posted on the platform of the online property broker *Immobilienscout24*.

[34] In the last quarter of 2015, the picture is more mixed, with prices of new offers responding less, and prices of last offers responding more than prices of all dwellings. The lower responsiveness of prices for new offers and higher responsiveness of prices for last offers may be explained by a combination of pricing and posting decisions of landlords. If there is a penalty attached to changing the price offer for a dwelling already posted online (e.g. customers may perceive such a change in price as a signal of bad quality of property), and future market prospects are hard to predict, then refraining from posting 'underpriced' offers until market uncertainty has resolved may well be optimal, as may be cuts in offer prices for existing posts if current demand is low and future prospects are both dim and uncertain.

the last quarter of 2015 and the first quarter of 2016, following the Cologne New Year's Eve incidents that shocked the country and fuelled public concerns about refugee immigration (Hewitt, 2016), may explain, at least in part, why price penalties attached to refugee immigration, respectively centralized refugee accommodation, have grown in size.

Fifth, we check the robustness of our findings when controlling for the current dwell times of flats posted online for rent. As shown in columns (7) and (8), however, our findings change but little. Estimated treatment effects for county-level refugee immigration levels are still negative throughout, precisely estimated, and virtually identical in magnitude to those in our baseline analysis. The same holds true for the impact of decentralized refugee accommodation in the last quarter of 2015. Furthermore, for the first quarter of 2016, decentralized refugee accommodation lacks statistical significance, as it did in our baseline analysis and in our last sensitivity check for last offers.

Finally, we add controls for local rental price caps on existing and new tenancy agreements, the latter of which have been imposed from June 2015 by state governments with tempo-spatial variation in selected areas that are characterized by excessively tight real estate markets (see columns (9) and (10)) (Fabricius, 2016).[35] Such rental price caps hence indicate two features of local real estate markets of potential relevance for our analysis, excessive market tightness and regulatory impediments to the ability of landlords to exploit such tightness in their pricing decisions. However, taking account of such caps in our analysis proves immaterial for our results. Estimated treatment effects increase only slightly but neither change their sign nor significance.

Recapitulating our various sensitivity checks above, we do find a consistent pattern of evidence for adverse price effects of refugee immigration at county level for both quarters investigated, October to December 2015 and January to March 2016. The same holds true for decentralized refugee accommodation in the last quarter of 2015, albeit with opposing sign. Estimated treatment effects for decentralized refugee accommodation in the first quarter of 2016 are more varied and less systematic. Insignificant in our baseline estimation, and also in several robustness checks, they are positive and significant on several occasions. Such occasions outnumber in frequency (by a score of three to one) occasions where decentralized accommodation exerted a statistically significant negative effect on YoY rental price growth. The greater variation and imprecision in 2016 first quarter estimates for type of refugee accommodation may owe to the fact that many temporary group quarters and outposts of reception centers that had been opened in the heyday of the 2015 refugee crisis in late 2015 (and entered our 2015 EoY stock-taking figures on regional refugee accommodation) were closed from February 2016 when numbers of new refugee arrivals to Germany began to abate greatly.

[35] Rental price caps on existing tenancy agreements have been imposed from May 2013 (i.e. prior to our observation period) in selected municipalities that are characterized by tight real estate markets (Haufe, 2016).

TABLE 5: IV RESULTS (SECOND STAGE) FOR QUARTERLY OUTCOME PERIODS - ROBUSTNESS TESTS II

	Dependent Variable: $\log(rent/m^2)$									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment Periods:										
$Oct-Dec_{2015}$	0.0357***	0.0316***	0.0309***	0.0273***	0.0313***	0.0244***	0.0357***	0.0317***	0.0355***	0.0304***
	(0.0018)	(0.0022)	(0.0029)	(0.0033)	(0.0037)	(0.0040)	(0.0018)	(0.0022)	(0.0018)	(0.0022)
$Jan-Mar_{2016}$	0.0495***	0.0505***	0.0601***	0.0568***	0.0545***	0.0548***	0.0497***	0.0505***	0.0481***	0.0479***
	(0.0018)	(0.0022)	(0.0034)	(0.0038)	(0.0028)	(0.0032)	(0.0018)	(0.0022)	(0.0017)	(0.0022)
Treatment Effects - Refugee Immigration:										
$Oct-Dec_{2015} \times ref_{c2015}/pop_{c2014}$	−0.7274***	−0.7107***	−0.5159**	−0.5562**	−0.9337***	−1.0683***	−0.7541***	−0.7380***	−0.9769***	−0.9842***
	(0.1347)	(0.1352)	(0.2209)	(0.2196)	(0.2921)	(0.2895)	(0.1338)	(0.1343)	(0.1258)	(0.1253)
$Jan-Mar_{2016} \times ref_{c2015}/pop_{c2014}$	−1.0978***	−1.1116***	−1.8747***	−1.9286***	−1.5978***	−1.6290***	−1.1656***	−1.1784***	−1.2920***	−1.3262***
	(0.1296)	(0.1301)	(0.2638)	(0.2617)	(0.2099)	(0.2087)	(0.1288)	(0.1294)	(0.1180)	(0.1183)
Treatment Effects - Refugee Accommodation:										
$Oct-Dec_{2015} \times decentr.\ share_{c2015}$		0.0097***		0.0102***		0.0214***		0.0095***		0.0128***
		(0.0024)		(0.0033)		(0.0036)		(0.0024)		(0.0024)
$Jan-Mar_{2016} \times decentr.\ share_{c2015}$		−0.0022		0.0100***		0.0001		−0.0018		0.0015
		(0.0025)		(0.0036)		(0.0033)		(0.0025)		(0.0025)
Current dwell time							−0.0015***	−0.0015***		
							(0.0000)	(0.0000)		
Type of offers	All		New		Last		All		All	
Rental price caps	No		No		No		No		Yes	
Municipality fixed effects	Yes		Yes		Yes		Yes		Yes	
Seasonal effects	Yes		Yes		Yes		Yes		Yes	
Flat-specific characteristics	Yes		Yes		Yes		Yes		Yes	
Lagged neighborhood characteristics (1km grid)	Yes		Yes		Yes		Yes		Yes	
Observations	1,985,590	1,982,767	1,001,652	1,000,101	1,001,652	1,000,101	1,985,590	1,982,767	1,985,590	1,982,767

NOTES: The endogenous variable is the log of the base rent per square meter posted. First stage regression results are omitted. For a list of the flat-specific characteristics considered, see Table A-2 in the appendix. Lagged neighborhood characteristics (from 2013) at 1km grid level include the unemployment rate, the share of the foreign-born population, and the share of buildings that are predominantly in commercial use prior to the crisis. To ease comparison, columns (1) and (2) reproduce the individual quarter effects corresponding to specifications (3) and (4) of Table 4. The number of fixed effects is 7,187 in column (1), (7) and (9), 7,171 in columns (2), (8) and (10), 6,426 in columns (3) and (5), and 6,411 in columns (4) and (6). Standard errors are robust to heteroscedasticity. ***, **, * denote statistical significance at the 1%, 5% and 10% level.

5 Conclusion

In this study, we investigated the shorter-run impacts of the 2015 mass arrival of refugees to Germany on residential housing rents. Using unique data on end of year county-level refugee populations and data on monthly offers of flats for rent from Germany's leading online property broker *Immobilienscout24*, we found strong evidence in difference-in-differences regressions for a negative effect of refugee immigration on rental prices. Importantly, however, these adverse price effects were attenuated, at least in the heyday of the crisis in late 2015, if a larger share of refugees was housed in decentralized accommodation rather than in centralized facilities. Various sensitivity analyses corroborated these findings, including IV regressions that exploit for identification information on the pre-crisis location of refugee reception centers and group quarters.

Our first finding of an adverse effect of refugee immigration on rental price growth does not agree with earlier findings in related studies which found a positive relationship between mass immigration and housing rents (Saiz, 2003; Tumen, 2016; Kürschner, 2016). While the reasons for this may be multifaceted, a likely prime factor is that refugees are simply different from other immigrants, at least in the subjective perceptions of natives. Natives' perception (justified or unjustified) that local refugee settlements, particularly if concentrated, are more of a disamenity that harms rental prices of property than non-refugee migrant settlements may sign responsible for our different findings. Our second finding of heterogeneous treatment effects of refugee immigration by type of refugee accommodation is consistent with this view and suggestive of an important role of such *'not in my backyard' (NIMBY)* perceptions of natives for real estate market outcomes.

Importantly, and related, our two findings show that the costs of refugee immigration for dwellers and landlords were, at least in part, determined by policy, i.e. the distributional policies and housing decisions of state authorities. While retro-perspective advice on what could have been done better is always difficult, and in the present context also likely misplaced, given the multiplicity of matters of concern to policy makers at the time and the great urgency to manage this unexpected and large inflow of refugees, our results do indicate clear costs of the decisions that were taken, costs that could be avoided, or at least lessened, in the future handling of refugee immigration and refugee housing. Unequal regional refugee immigration (allocation) distorts regional housing markets unequally and harms prices more in regions that experience larger refugee inflows. A more equitable distribution of refugees across regions would hence lead to a more equitable distribution of such cost across regions. Similarly, a more expeditious transfer of new refugee arrivals form centralized accommodation facilities to decentralized accommodation would attenuate the size of such rent penalties attached to the local housing of refugees, as would a generally greater share of refugees in such dwellings. Adopted amendments to the existent legislation (Act on the Acceleration of Asylum Procedures (AsylVfBeschlG)) in the heyday of the crisis, which extended the requirement for asylum seekers to live in a designated reception center (or affiliated branch thereof) from at most three to a most six months, are clearly counter-productive in this respect and cast doubt on whether such benefits from a more equitable and dispersed allocation will be reaped in the future.

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A Appendix

TABLE A-1: 2015 EOY ASYLUM SEEKERS AND ASYLUM APPLICATIONS IN 2015

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Koenigstein Key	Asylum Seekers		Asylum Applications		(3)−(1)	(5)−(1)
Federal State:	%	total	%	total	%	%-pt.s	%-pt.s
Baden-Wuerttemberg	12.975	121,280	12.445	57,578	13.030	-0.530	0.055
Bavaria	15.330	126,185	12.949	67,639	15.306	-2.382	-0.024
Berlin	5.046	49,654	5.095	33,281	7.531	0.050	2.486
Brandenburg	3.081	29,339	3.011	18,661	4.223	-0.070	1.142
Bremen	0.941	11,159	1.145	4,689	1.061	0.204	0.120
Hamburg	2.528	23,051	2.365	12,437	2.814	-0.162	0.287
Hesse	7.316	68,122	6.990	27,239	6.164	-0.325	-1.151
Mecklenburg Western Pomerania	2.042	20,332	2.086	18,851	4.266	0.045	2.224
Lower Saxony	9.357	101,251	10.390	34,248	7.750	1.033	-1.607
Northrhine-Westphalia	21.241	224,089	22.995	66,758	15.107	1.755	-6.133
Rhineland Palatinate	4.835	49,475	5.077	17,625	3.988	0.242	-0.846
Saarland	1.216	10,411	1.068	10,089	2.283	-0.147	1.067
Saxony	5.101	45,749	4.695	27,180	6.151	-0.406	1.050
Saxony-Anhalt	2.858	30,073	3.086	16,410	3.714	0.228	0.856
Schleswig-Holstein	3.388	35,935	3.688	15,572	3.524	0.300	0.136
Thuringia	2.748	28,401	2.914	13,455	3.045	0.166	0.296
Unknown				187	0.042		
Total	100	974,506	100	441,899	100		

NOTES: The table shows for each federal state the total number of asylum seekers on 31st December 2015 recorded in the *Statistic on Asylum Seekers' Benefits*, the federal state quota of refugees to be allocated according to the Koenigstein Key, and the number of asylum applications filed in 2015.

TABLE A-2: SUMMARY STATISTICS I: FLAT-SPECIFIC CHARACTERISTICS

	mean	std. dev.	min.	max.
rent/m^2 [EUR]	7.600	3.269	1.00	100.00
log rent/m^2	1.956	0.366	0	4.605
living space [m^2]	73.793	30.586	6	500
log living space	4.224	0.394	1.792	6.215
#rooms	2.645	0.969	1	10
level: LG-1	0.439	0.496	0	1
level: 2-5	0.535	0.499	0	1
level: 6-11	0.023	0.151	0	1
level: > 11	0.003	0.056	0	1
elevator: not stated (n.s.)	0.082	0.274	0	1
elevator: Y	0.210	0.408	0	1
balcony: n.s.	0.039	0.194	0	1
balcony: Y	0.641	0.480	0	1
fitted kitchen: n.s.	0.088	0.283	0	1
fitted kitchen: Y	0.351	0.477	0	1
construction period: n.s.	0.202	0.404	0	1
construction period: < 1915	0.112	0.315	0	1
construction period: 1915-1945	0.065	0.247	0	1
construction period: 1946-1969	0.195	0.396	0	1
construction period: 1970-1989	0.188	0.391	0	1
construction period: 1990-2005	0.147	0.354	0	1
construction period: > 2005	0.091	0.287	0	1
Object category (OC): n.s.	0.162	0.368	0	1
OC: other	0.015	0.120	0	1
OC: attic	0.128	0.334	0	1
OC: loft	0.004	0.061	0	1
OC: maisonette	0.038	0.190	0	1
OC: penthouse	0.010	0.099	0	1
OC: terrace	0.015	0.122	0	1
OC: ground floor	0.080	0.272	0	1
OC: level flat	0.527	0.499	0	1
OC: souterrain	0.005	0.071	0	1
OC: mezzanine	0.017	0.130	0	1
fittings: n.s.	0.425	0.494	0	1
fittings: basic	0.009	0.092	0	1
fittings: normal	0.303	0.459	0	1
fittings: upscale	0.234	0.424	0	1
fittings: luxury	0.029	0.169	0	1
under constr.	0.003	0.052	0	1
same yr. constr.	0.027	0.161	0	1
existing housing stock	0.971	0.169	0	1
distance to county-level pop. center [km]	8.552	7.343	0	103.87
current dwell time [$months$]	4.803	9.355	1	111

NOTE: The total number of flat-month observations is 1,986,303.

TABLE A-3: SUMMARY STATISTICS II: MAIN EXPLANATORY VARIABLES, INSTRUMENTS, COUNTY AND NEIGHBORHOOD CHARACTERISTICS

	obs.	mean	std. dev.	min.	max.
Main explanatory variables					
refugees '15/pop. '14	402	0.0120	0.0074	0.0002	0.0908
share refugees in decentralized accommodation '15	400	0.5005	0.3517	0	1
Instrumental variables					
inverse log average travel distance	402	0.1949	0.1163	0.1506	1
county-level share of group quarter municipalities	402	0.4347	0.4208	0	1
Total population growth					
population growth '14-'15	402	0.0109	0.0074	-0.0055	0.0594
Lagged county characteristics					
GDP p.c. '13 [EUR]	402	32,656.84	14,337.69	14,436	130,103
property market: vacancy rate '11 [%]	402	0.0482	0.0218	0.0140	0.1397
property market: building permits (flats) '13/pop. '13	402	0.0028	0.0016	0.0004	0.0102
amenities: annual guest arrivals (tourism) '13/pop. '13	402	1.8373	1.5049	0.2395	10.0353
(dis-)amenities: crimes '13/pop. '13	402	0.0629	0.0259	0.0232	0.1466
Lagged neighborhood characteristics (1km grid-level)					
unemployment rate '13 [%]	48,448	5.6531	4.0399	0	37.48
foreigner share '13 [%]	48,448	6.1583	6.3833	0	95.92
property composition: commercial buildings '13 [%]	48,448	3.2141	5.8050	0	100