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Unintended Consequences of the 2015 Refugee Surge on Residential Building Permits in Germany

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Abstract: In this paper, we examine how building permit rates, in particular those for housing in one- and two-family homes, were affected by the presence of refugees in the wake of the 2015/16 refugee surge in Germany. Our panel data set covers all German counties with available data over the years 2011–2019. Our results show that a larger presence of refugees tended to lower the building permit rate, not in the very short run but over time. The effect is concentrated in the years 2017–2019 at the end of our sample. On average over those years, a doubling of the population's refugee share induced a decline in the permit rate by 7 %–9 %. This suggests a lower future housing supply as a potential unintended consequence of the refugee surge.

Keywords: refugee surge; building permit rate; panel data; Germany

JEL Classification: F22; R1; R31; R38

1 Introduction

In late August of 2015, Germany temporarily suspended the Dublin-rule for asylum seekers according to which they are required to claim asylum status in the first EU country they arrive in. This was followed shortly thereafter by the decision to have the country accept a very large number of refugees from Syria and a number of other countries. As a result, Germany experienced an extraordinary refugee inflow during the years 2015 and 2016. A number of recent studies have explored the impact of the 2015/16 refugee surge on a variety of issues, including crime (Dehos 2021; Entorf and Lange 2023; Gehrsitz and Ungerer 2022; Lange and Sommerfeld 2024), voting behavior (Fremerey, Hörnig, and Schaffner 2024), and employment (Berbée et al. 2022; Gehrsitz and Ungerer 2022). This study extends this literature by analyzing the effect of the German refugee inflow on residential building permits.

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In a separate strand of the literature on countries other than Germany, numerous studies have explored the impact of immigration (Gonzalez and Ortega 2013; Mussa, Nwaogu, and Pozo 2017; Pavlov and Somerville 2020; Sá 2015; Saiz 2007) and refugees (Rozo and Sviatschi 2021; Tumen 2016; Van Vuuren, Kjellander, and Nilsson 2019) on housing markets. These studies primarily capture the effects on housing rents and prices. But, as shown by Gonzalez and Ortega (2013), immigration can impact not only housing prices but also construction activity. In this study, we connect this strand of the literature with that on the impact of the 2015/16 refugee surge into Germany.

The connection between refugee inflows and residential building permits may not be apparent at first glance and neither may be its policy relevance. We suggest three ways in which a refugee surge could impact building permits. First, the construction of refugee shelters may reduce construction-ready land for traditional housing units in the short run. Second and also with a temporary impact, building authorities may be overwhelmed by managing the refugee surge, including the construction of shelters, which may slow down or delay the building permit process for traditional housing units. Third and beyond the short run, large refugee inflows can lead to a decline in the building permits of traditional housing units because potential home owners reassess their decision to build or buy in areas experiencing a refugee surge. Related behavioral changes in areas of refugee concentration have been noticed before in studies on real estate markets. Examples include Saiz (2007), Tumen (2016), and Mussa, Nwaogu, and Pozo (2017). Similarly, Sá (2015) find that house prices decrease as immigration rises in the United Kingdom. Van Vuuren, Kjellander, and Nilsson (2019) provide concurring evidence at the micro level in a study on the impact of the announcement of temporary refugee sites on adjacent apartment prices in Gothenburg, Sweden: the announcement lowered apartment prices within a 5-minute radius.

If a refugee surge has only a temporary impact on building permits, the economic consequences are limited: the construction of some housing units will be delayed. A longer-lasting impact on residential building permits may eventually translate into fewer additions to the housing supply, which is a concern when there is a dearth of affordable housing as in much of Germany.

For our analysis, we employ a panel data set on German counties for the years 2011–2019. The data are similar to those of Lerbs (2014), which is one of only a few studies that examine the determinants of building activity for Germany. Similar to McGinnis (1994), we differentiate between different types of permit rates to zero in on the impact of the refugee surge on traditional building permits.

A key inference issue we face is that the distribution of refugees to the 16 German states is based on a federal quota system.[1] It ensures that all counties and all cities with county status are affected by the inflow of refugees. However, this prevents us from using a traditional difference-in-differences analysis as there exists no ready control group without refugee exposure. Therefore, we conduct a more traditional before/after analysis similar to other studies (e.g., Lange and Sommerfeld 2024). To avoid problems with preexisting trends, we include a large number of time fixed effects to allow different types of counties to follow different trends. We also check our results with alternative estimators and refugee data.

Our results on traditional building permits for housing units in one- or two-family homes suggest that one can rule out that the 2015/16 refugee surge had only temporary effects on building permits. Most of the effects occur after 2016, and they tend to gain momentum over time. This suggests a longer lasting impact of the refugee surge on building permits. On average, for the years 2017–2019, a doubling of the refugee rate (an increase by 100 %) is likely to have induced a decline in the permit rate of between 7 % and 10 %. Our sensitivity checks with alternative refugee data and instrumental variable methods point into the same direction. We suggest that this longer lasting reaction of a core segment of building permits, which relates to individual-family decision making, is likely to have lowered additions to the housing supply. Given Germany's lack of sufficient building activity, this outcome of the refugee crisis can be considered an unintended consequence.

We organize our paper as follows. Our data and methodology are presented next. This is followed by our empirical results, several sensitivity checks, and our conclusions.

2 Data and Methodology

2.1 Data

Our data set covers a maximum of 390 out of 401 counties and cities with county status in Germany.[2] For simplicity, we refer to *counties* in the remaining text, which include both counties and cities with county status. The panel data include yearly

1 The refugee quota follows the so-called Königstein Key, which is based on regional tax revenue and population levels.

2 No refugee data can be allocated to 11 counties because their data are added to those of other counties. This includes in particular all counties in the state of Saarland. The missing counties have the following IDs: 6611, 6633, 10041, 10042, 10043, 10044, 10045, 10046, 12052, 12071, 16056.

Table 1: Data definitions; source.

Variable	Description; source
prm_all	Building permit rate, all residential housing units per 1,000 residents; INKAR variable 47: "Baugenehmigungen für neue Wohnungen je 1.000 Einwohner"
prm_12	Building permit rate, residential housing units in 1 and 2 family homes; INKAR variable 48 × INKAR variable 47/100
refg	Share of refugees in population; INKAR variable 153 ("Anteil Schutzsuchender an Bevölkerung in %")
treatxx	0/1 indicator variable, equal to 1 for the years 20xx through 2019, 0 otherwise
land_sold	Area of land sold in 1,000 square meter ready for housing structures; *Regionaldatenbank* table 61511-01-03-4 ("Bauland")
shr_foreigners	Share of foreigners in population, in %; INKAR variable 142
net_migration	Net change in population due to moving, per 1,000 residents; INKAR variable 157
bl_price	Average value per square meter of land ready for housing structures; INKAR variable 46
unemp	Share of unemployed persons in civilian labor force, in %; INKAR variable 12
pop	Population in 000s; INKAR variable 2/1000
gdp	Gross domestic product in million Euro; INKAR variable 11/1000
vacancy	Residential vacancy rate in 2011, in %; *Regionaldatenbank* table AI-Z4-2011 ("Leerstandsquote")
CFE	County fixed effects
year	0/1 indicator variables for years from 2011 to 2019, used for time fixed effects
west	0/1 indicator variable, equal to 1 for counties in the western part of Germany, 0 otherwise; INKAR county reference table for 2020
big7	0/1 indicator variable, equal to 1 for the seven largest cities (Berlin, Hamburg, Munich, Cologne, Frankfurt, Stuttgart, Düsseldorf), 0 otherwise
s_county	County categories by population density (4 levels: large city, urban county, rural county with some agglomeration, sparsely populated rural counties); INKAR county reference table for 2020
growth	County categories by growth momentum (5 levels: above average growth, growing, no discernible direction of growth, shrinking, above average shrinkage); INKAR county reference table for 2020
Variables from Lange and Sommerfeld (2024) (LS):	
refg_infl	Refugee inflow per 100,000 residents per year; variable *refg_inflow2* from LS
refg_IV	Refugee inflow on the basis of fixed ex ante allocation quotas (Section 3.2 of LS)
EAE	0/1 indicator variable, equal to 1 for counties with an initial refugee reception center
military	Number (0–5) of empty military installations able to house refugees

Notes: INKAR is a data base of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR), https://www.inkar.de/; *Regionaldatenbank* is the regional data base of the German state and federal statistical offices (https://www.regionalstatistik.de/).

observations from 2011 to 2019. Our panel setup is unbalanced, as there are missing observations for a number of variables. We exclude the year 2020 and all following years, as the Corona/Covid pandemic caused a delay in new housing construction

Table 2: Basic statistics.

Variable	Observations	Mean	Median	Std. dev.	Min	Max
prm_all	3,165	3.19	2.89	1.84	0.26	15.57
prm_12	3,165	1.57	1.38	0.92	0.13	5.38
refg	3,165	1.25	1.02	0.92	0.03	12.43
treat15	3,165	0.56	1	0.50	0	1
treat16	3,165	0.45	0	0.50	0	1
treat17	3,165	0.35	0	0.48	0	1
land_sold	3,113	202.93	147	221.69	1	2,692.00
shr_foreigners	3,165	8.53	7.69	5.19	0.66	36.56
net_migration	3,165	5.44	5.04	5.57	−23.20	51.24
bl_price	3,165	163.73	104.36	200.60	0	2,692.79
unemp	3,165	5.80	5.22	2.85	1.25	16.63
Pop	3,165	211.95	157.29	248.68	34.06	3,669.49
gdp	3,165	7,906.47	4,791.17	12,544.89	1056.85	157,130.75
vacancy	3,102	4.66	4.10	2.22	1.30	14.00
Variables from Lange and Sommerfeld (2024) (2013–2018):						
refg_infl	2,067	305.26	208.40	285.64	21.44	3,028.36
refg_IV	2,067	413.52	214.23	421.55	0	2,626.46
EAE	2,067	0.08	0	0.27	0	1
military	2,067	0.28	0	0.70	0	5

Notes: The variables cover the years 2011–2019, except noted otherwise. 2 observations are zero for variable *bl_price*. These are dropped in the equations when logs are applied. The results are not materially affected. For variable *vacancy*, the 2011 values are entered for all other years.

(Mohammed et al. 2021). Our main data source is the INKAR data base,[3] with some additional variables drawn from the German regional data bank.[4] Variable definitions and source codes are provided in Table 1 and basic statistics in Table 2. For some sensitivity checks, we also draw on alternative refugee data and some other variables from Lange and Sommerfeld (2024). These data are available only for the years from 2013 to 2018, which reduces the number of observations by about a third. The variables associated with this alternative data set are covered in the last four rows of Tables 1 and 2.

Our variable to explain is the residential building permit rate. Building permits are a good indicator of the current state of the real estate market, as they capture current decision making (Lerbs 2014). Therefore, they should be sensitive to temporary processing problems of overwhelmed building authorities on the one hand and possible sentiment changes by prospective home builders. Our permit

3 Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR), Bonn: https://www.inkar.de/.

4 Regionaldatenbank, https://www.regionalstatistik.de/genesis/online/.

rates are defined as the number of residential housing units in new buildings per 1,000 residents.[5] We differentiate between two permit series, those for all housing units, regardless of what type of building they are in, and one of its two components, the permits for housing units in one- and two-family houses. The latter we will call *traditional* permits. We omit permits for housing units in buildings with 3 or more units, which includes high-rise apartment buildings, student and senior dormitories, and refugee shelters.

Our focus is on the traditional permit rate. In contrast to building permits for units in multi-family buildings, the traditional permit rate is less likely driven by public policy objectives, such as providing housing for refugees or the decision making of commercial housing developers. In that sense, traditional permits more closely capture the individual-family decision making about home building and the extent to which they may be influenced by the influx of refugees. If the building authorities were indeed overwhelmed in 2015/16 in their efforts to provide for refugee housing, their attention to permits involving traditional permits would likely have suffered more than their attention to housing units in multi-family buildings, which includes refugee centers. If, by contrast, the refugee surge is associated with fewer traditional permits not only in the wake of the refugee surge but for years thereafter, it becomes difficult to blame overwhelmed building authorities. A more likely reason for such a longer lasting development would be a sentiment change among prospective home builders.

For our refugee data, we rely on a very general measure, the share of the population seeking protection from war or persecution (*refg* in Table 1). The 2015/16 refugee wave increased that share significantly. To distribute the burden of refugee inflows, refugees have been registered and dispersed into all German states and counties according to the Königstein Key since 1993. However, the 2015/16 surge overwhelmed many local authorities leading to numerous local adjustments to avoid homelessness. In addition, refugees often took things into their own hand and moved on from their designated localities. These issues are discussed in detail in the literature on the impact of the 2015/16 refugee surge into Germany (e.g., Berbée et al. 2022; Gehrsitz and Ungerer 2022; Lange and Sommerfeld 2024). As they may induce endogeneity of the general refugee numbers, we also employ in a sensitivity check an alternative refugee series from Lange and Sommerfeld (2024) along with an instrumental variable measure devised by these authors and tied to the Königstein Key.

We apply economic, demographic, and housing-related controls. First, we control for economic variation across counties through the inclusion of unemployment

5 Lerbs (2014) calculates the building permit rate by dividing the number of new building permits, irrespective of the number of housing units, by the total stock of buildings.

and GDP variables. Demographic changes are captured by the level of population, net migration, and the share of foreigners in the population. A larger share of foreigners, in particular, may moderate the response of building permits similar to how it moderated the response of hate crimes to foreign-born residents in a recent study by Entorf and Lange (2023) of the 2015/16 refugee crisis. In terms of housing-related controls, we rely on two variables: the area of land sold that is ready for housing construction and the average price of that land. We expect that building permits increase when land transactions increase as new owners are more likely to build on previously vacant land.

2.2 Methodology

Our base regression model takes the form

$$\begin{aligned} \ln prm_{it} &= \vartheta_i + \delta_t + \sum_{j=1}^{J} \eta_j cntrl_{j,it} + \sum_{h=1}^{H} \sum_{t=2012}^{2019} \gamma_{ht} 1\{year = t\} \times cnty_{ih} \\ &+ \sum_{t=2011, t\neq 2014}^{2019} \beta_t 1\{year = t\} \times \ln refg_{it} + \varepsilon_{\mathrm{it}}, \end{aligned} \tag{1}$$

where the dependent variable is the logarithm of the building permit rate (*prm*) of county i in year t and where ε_{it} is the equation's error term. The term ϑ_i denotes county fixed effects, which control for all observed and unobserved time-invariant county-specific factors. These include locational characteristics that do not change with time. By contrast, the term involving *cntrl* captures J county-specific, time-varying control variables, such as unemployment.

δ_t represents country-wide time fixed effects, which capture time-varying factors at the federal level that affect all counties. As an example, δ_t controls for the impact of changes over time in country-wide price levels, interest rates, environmental standards, and a host of other variables that may affect building permits. The term involving *cnty* in Equation (1) represents interactions between our time fixed effects variable *year* and H time-invariant county attributes. These relate to the variables *west*, *big7*, *s_county*, and *growth* in Table 1. The term allows for time fixed effects to differ across (a) the western and eastern counties of Germany, (b) the cities belonging to the *big7* group and all other counties, (c) the four county categories based on differences in population density, and (d) the five county categories based on different levels of growth momentum. This specification makes it possible for important time-invariant county characteristics to influence not only the *level* of the dependent variable but also how it evolves over time. It also acknowledges the fact that country-wide time fixed effects, as given by δ_t in Equation (1), are unlikely to capture the heterogeneity in observed trends across counties. With our specification, each county is influenced by a sizable number of potentially different time trends above and beyond any country-wide trend.

The term involving variable *refg* in Equation (1) captures the impact of refugees on the building permit rate. By interacting *refg* with the time fixed effects variable *year*, we allow the data to determine whether and in which year a change in the refugee rate impacted the building permit rate. Since the dependent variable and the refugee variable are both expressed in logarithms, β_t in Equation (1) represents a series of elasticities of the building permit rate with respect to the refugee share. If there was no appreciable response of the permit rate to changes in the refugee share before the refugee surge of 2015/16, we expect the β_t to be zero before 2015. Similarly, if the 2015/16 refugee surge made building permits more responsive to the refugee share, we expect to see some or all of the β coefficients to be different from zero starting in or after 2015. The sequence of elasticity values β_t over time also allow us to differentiate between the two key competing hypotheses of the refugee surge. An immediate but temporary rise in the responsiveness of building permits to the refugee surge would point toward a lack of land for development or overwhelmed building authorities. A more gradual but longer lasting response would more likely be associated with potential home owners reassessing their decision to build in the aftermath of the refugee surge.

We investigate the short-run versus longer run impact of the 2015/16 refugee surge also by Equation (2),

$$\begin{aligned} \ln prm_{it} &= \vartheta_i + \delta_t + \sum_{j=1}^{J} \eta_j cntrl_{j,it} + \sum_{h=1}^{H} \sum_{t=2012}^{2019} \gamma_{ht} 1\{year = t\} \times cnty_{ih} \\ &\quad + \beta_0 \ln refg_{it} + \beta_1 treat_t \cdot \ln refg_{it} + \varepsilon_{\text{it}}, \end{aligned} \tag{2}$$

where *treat* stands for a 0/1 treatment indicator variable that turns from 0 to 1 either in 2015 or later and that remains at 1 for the remainder of the sample. For a short-run, temporary impact, we would expect the coefficient β_1 to be smaller in absolute terms and less statistically significant the longer after the refugee surge variable *treat* turns from 0 to 1, e.g., 2017 as opposed to 2015. Just the opposite is to be expected if the refugee impact is gaining momentum in the longer run. We note that β_0 represents the elasticity of the building permit rate with respect to the refugee share prior to the refugee surge. By contrast, the sum of the coefficients β_0 and β_1 represents the elasticity after the surge.

We conduct two sensitivity checks. The first one is intended to rule out reverse causality concerns for our control variables by replacing the J contemporaneous controls with interactions between our time fixed effects variable *year* and the beginning-of-sample (2011) values of our control variables,

$$\begin{aligned}\ln prm_{it} &= \vartheta_i + \delta_t + \sum_{j=1}^{J}\sum_{t=2012}^{2019}\theta_{jt}1\{year = t\} \times cntrl(t = 2011)_{j,i}\\ &\quad + \sum_{h=1}^{H}\sum_{t=2012}^{2019}\gamma_{ht}1\{year = t\} \times cnty_{ih}\\ &\quad + \sum_{t=2011, t\neq 2014}^{2019}\beta_t 1\{year = t\} \times \ln refg_{it} + \varepsilon_{\text{it}}.\end{aligned} \tag{3}$$

This is an approach applied, among others, by Jeanty, Partridge, and Irwin (2010).

In a second sensitivity check, we draw on alternative refugee data, an associated instrumental variable, and some additional control variables (Lange and Sommerfeld 2024). The refugee data for this check come from the Federal Office of Migration and Refugees (BAMF) and cover the time period 2013–18, instead of the years 2011–19. The alternative refugee variable (*refg_infl*) represents inflows of refugees per 100,000 residents per year,[6] in contrast to the end-of-year stock variable *refg* that is being used for the baseline estimates. Since the refugee numbers induce a potential endogeneity bias due to endogenous sorting by refugees or last-minute refugee reallocations by local authorities, Lange and Sommerfeld (2024, Section 3.2) construct an instrumental variable (IV) for the refugee inflow variable. This IV predicts the number of refugees per county on the basis of fixed ex ante allocation quotas that are not influenced by the actions of refugees or local authorities. For our checks with the alternative refugee data and the IV estimates, we rely on simplified versions of Equations (1) and (2) over the period from 2013 to 2018.

3 Results

3.1 Baseline Regression Results

The regression results from estimating Equations (1)–(3) on the baseline refugee data (*refg* in Table 1) over the period 2011–2019 are collected in Table 3, with the dynamic elasticity estimates pictured in Figures 1–3.[7] All models in the table contain a full set of control variables, county fixed effects (*CFE*), country-wide fixed effects (*year*), and a large number of interactions between time fixed effects (*year*) and time-invariant county characteristics, such as a location in the western as opposed to the eastern part of Germany.

6 The refugee inflow series corresponds to variable *refg_inflow2* in the data graciously provided by Lange and Sommerfeld (2024).

7 The estimated building permit elasticities with respect to the refugee variable are identified in Figures 1–3 by dots and connected by a solid line. The broken lines above and below delimit 95 % confidence bands.

Table 3: Models estimated with baseline refugee data, 2011–19.

Dependent variables:	**log(*prm_all*)**	**log(*prm_12*)**			
Model:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Focus variables					
log(*refg*) × *year*	Figure 1	Figure 2			Figure 3
log(*refg*)			0.0036	0.0051	
			(0.0297)	(0.0301)	
log(*refg*) × *treat15*			−0.0759*		
			(0.0344)		
log(*refg*) × *treat16*				−0.0927***	
				(0.0262)	
Control variables					
log(*unemp*)	−0.2981*	−0.2318*	−0.2337*	−0.2310*	log(*unemp*[2011]) × *year*
	(0.1419)	(0.1145)	(0.1111)	(0.1121)	
log(*gdp*)	0.0976	−0.0492	−0.0296	−0.0253	log(*gdp*[2011]) × *year*
	(0.2624)	(0.1724)	(0.1761)	(0.1770)	
log(*pop*)	−4.745***	−5.707***	−5.688***	−5.733***	log(*pop*[2011]) × *year*
	(1.353)	(0.9357)	(0.9343)	(0.9379)	
shr_foreigners	0.0552*	0.0250	0.0206	0.0239	*shr_foreigners*[2011] × *year*
	(0.0255)	(0.0188)	(0.0188)	(0.0182)	
log(*land_sold*)	0.0786**	0.0888***	0.0890***	0.0893***	log(*land_sold*[2011]) × *year*
	(0.0245)	(0.0188)	(0.0186)	(0.0186)	
net_migration	0.0017	0.0074***	0.0078***	0.0075***	*net_migration*[2011] × *year*
	(0.0019)	(0.0019)	(0.0018)	(0.0018)	
log(*bl_price*)	0.1824**	0.1245***	0.1316***	0.1269***	log(*bl_price*[2011]) × *year*
	(0.0650)	(0.0274)	(0.0280)	(0.0273)	
log(*vacancy*)					log(*vacancy*[2011]) × *year*
Fixed-effects (#)					
CFE (390)	Yes	Yes	Yes	Yes	Yes
year (9)	Yes	Yes	Yes	Yes	Yes
west × *year* (18)	Yes	Yes	Yes	Yes	Yes
big7 × *year* (18)	Yes	Yes	Yes	Yes	Yes
s_county × *year* (36)	Yes	Yes	Yes	Yes	Yes
growth × *year* (45)	Yes	Yes	Yes	Yes	Yes
Observations	3,113	3,113	3,113	3,113	2,928
adjusted R^2	0.84629	0.91476	0.91434	0.91453	0.91815

Notes: Clustered (*CFE* & *year*) standard errors in parentheses. The number of fixed effects are provided in parentheses in the fixed effects section. Signif. codes: ***0.01, **0.05, *0.1.

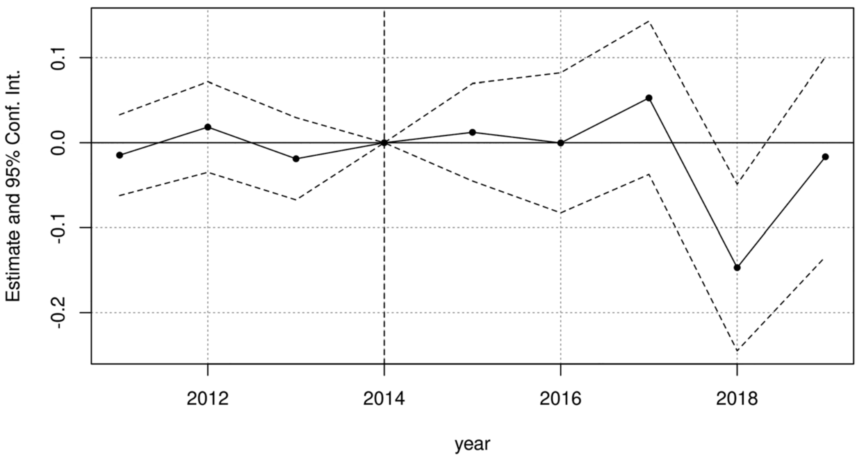

Figure 1: Refugee variable interacted with *year* time fixed effects (Table 3, Mod. 1, *prm_all*).

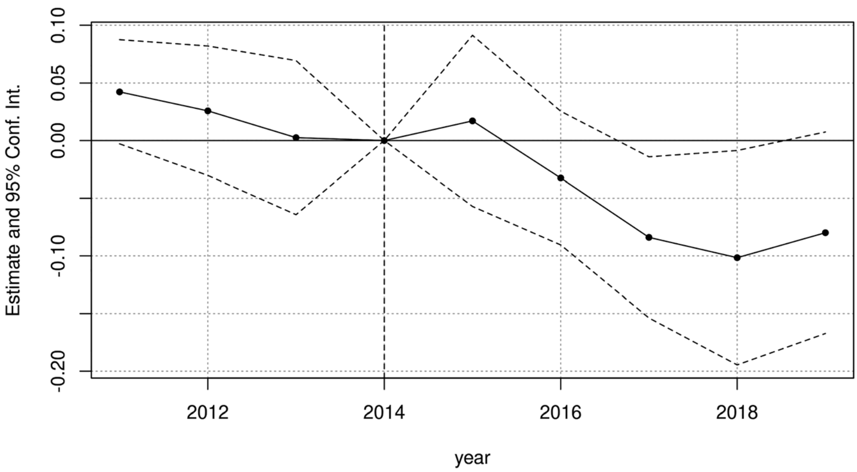

Figure 2: Refugee variable interacted with *year* time fixed effects (Table 3, Mod. 2, *prm_12*).

Models (1) and (2) differ only in terms of the dependent variable. Model (1) and Figure 1 provide the results for the building permit rate for residential housing units in all types of buildings, from single- and multi-family homes to senior homes and refugee centers. We can observe in Figure 1 a movement away from zero in the elasticity of permits with respect to refugees in 2017 and 2018, with only the 2018

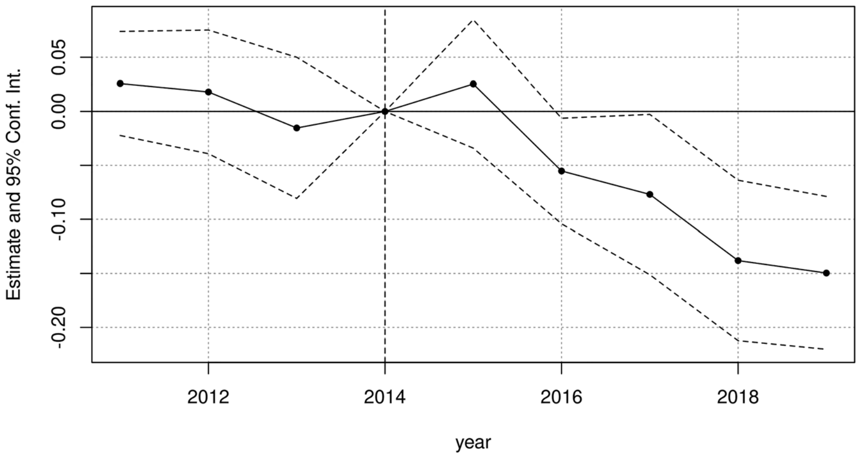

Figure 3: Refugee variable interacted with *year* time fixed effects (Table 3, Mod. 5, *prm_12*).

deviation being statistically significant. Overall, there appears to be no systematic reaction in the elasticity of building permits to the refugee crisis. This is not entirely surprising as permits for all types of housing, including those for refugee centers, are lumped together. By contrast, Model (2) and Figure 2 focus on what we call traditional building permits, those for housing in one- or two-family homes, on which we will focus in all remaining regressions.

In Figure 2, we can observe a distinct downward trend in the elasticity estimates for the traditional permit rate. This trend entails an increasing (negative) sensitivity of the permit rate to the refugee rate. It sets in 2016 and keeps the elasticity of building permits with respect to refugees in the range between −0.08 and −0.10 for the remainder of the sample. Values in that range imply that a doubling of the refugee rate, a common occurrence in the wake of the refugee surge, would drop the traditional permit rate by 8–10 percent.

The shape of the downturn in the elasticity values and the evolution of their absolute size suggest that the 2015/16 refugee surge had a more sustained, longer-lasting impact than what can be expected from temporary administrative issues by the building permit authorities.

That the refugee surge had more than a short-run impact on the elasticity of traditional building permits is underscored by Models 3 and 4 of Table 3. These models correspond to Equation (2) and capture in condensed format the change that occurred in the building permit elasticity after the refugee surge. Model (3) puts the building permit elasticity at 0 before 2015 and at −0.08 from 2015 to the end of the sample. Model (4) replicates the estimates with 2016 replacing 2015 as the treatment year. The elasticity value before 2016 remains at zero, while that from 2016 onward reaches −0.09. Unreported results show that the estimated coefficients do not materially change if 2017 replaces 2016 as the treatment year. These estimates confirm the message of Figure 2: the sensitivity of building permits to the share of refugees in the resident population tends to rise in absolute terms after the refugee surge, instead of declining again after an initial uptick. This speaks against a temporary impact of the refugee surge on the building permit elasticity and in favor of a longer lasting impact, one that gains momentum over time.

3.2 Sensitivity Checks

Model 5 of Table 3 identifies the structure of a first sensitivity check of the results contained in Models 2 through 4. It implements Equation (3) where all contemporaneous values of the control variables are replaced with interactions between their 2011 values and the time fixed effects variable *year*. These interactions put the counties' building permits on different time paths conditional on the 2011 values of the counties' control variables.[8] It rules out endogeneity issues that may arise from the control variables.

Figure 3 illustrates the estimation results of Model 5 that are of interest to us: the responsiveness of the traditional building permit rate to the share of refugees in the population over time. The figure strongly confirms the results of Models 2–4 of Table 3. Two results stand out. First, the refugee share at the county level has no statistically significant impact on the building permit rate prior to 2016. The elasticity of traditional building permits with respect to the refugee share is effectively zero. Second, building permits become responsive to the refugee share in a statistically significant way in 2016. Importantly, the impact of the refugee share is not of the short-run, temporary type, but its impact gains momentum over time. This points toward a material, longer run increase in the absolute value of the elasticity of building permits with respect to the share of refugees in the population. In particular, Figure 3 suggests that a 100 % increase in the population's refugee share, say from 1 % to 2 %, lowers the permit rate by approximately 15 % by 2018 or 2019.

Table 4 collects a number of additional sensitivity checks. These cover the estimation results for alternative refugee data, explore the influence of additional control variables adapted from related work on the impact of refugees by Lange and Sommerfeld (2024), and check to what extent endogeneity in the refugee data may

8 This change to the control variables increases the number of estimated parameters for the control variables in Model 5 by a factor of 8 relative to Model 2.

Table 4: Sensitivity checks with alternative refugee data, more controls, and IV estimation, 2013–18.

Dependent variable:	**log(*prm_12*)**					
Model:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Focus variables						
log(*refg_infl*)	−0.0304	0.0002	−0.0708***			
	(0.0156)	(0.0166)	(0.0097)			
log(*refg_infl*) × *treat16*		−0.0448*				
		(0.0216)				
log(*refg*)				−0.0470	−0.0245	−0.6056
				(0.0688)	(0.0658)	(0.6650)
log(*refg*) × *treat16*					−0.0856***	
					(0.0165)	
Control variables						
log(*unemp*)	−0.0459	−0.0226	−0.0521	−0.0315	0.0192	0.1201
log(*gdp*)	−0.0993	−0.1036	−0.1180	−0.0726	−0.1041	0.1171
log(*pop*)	−4.579**	−4.747**	−4.537***	−4.673**	−4.700**	−6.176**
shr_foreigners	−0.0038	0.0023	−0.0009	−0.0039	0.0141	0.0333
log(*land_sold*)	0.0626**	0.0617**	0.0620**	0.0635**	0.0609**	0.0655**
net_migration	0.0062**	0.0059**	0.0067***	0.0059**	0.0054**	0.0059**
log(*bl_price*)	0.1421***	0.1401***	0.1402***	0.1442***	0.1338***	0.1412**
EAE	0.0287	0.0230	0.0388***	0.0256	0.0235	0.0920
First stage results						
log(*refg_IV*)			0.2765**			0.0323
			(0.0838)			(0.0334)
shr_foreigners			0.1192**			0.0704**
			(0.0332)			(0.0230)
EAE			0.3122			0.1242*
			(0.2670)			(0.0524)
F-stat (1/2022 DoF)			35.50***			2.61
Fixed-effects						
CFE	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
west × *year*	Yes	Yes	Yes	Yes	Yes	Yes
big7 × *year*	Yes	Yes	Yes	Yes	Yes	Yes
s_county × *year*	Yes	Yes	Yes	Yes	Yes	Yes
growth × *year*	Yes	Yes	Yes	Yes	Yes	Yes
military × *year*	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,041	2,041	2,032	2,041	2,041	2,032
adjusted R^2	0.93252	0.93274	0.93212	0.93241	0.93283	0.91985

Notes: Models (3) and (6) are estimated by IV. See Table 1 for definitions of variables *refg_infl*, *EAE*, *military* and the IV variable. Clustered (*CFE* & *year*) standard errors in parentheses. Signif. codes: ***0.01, **0.05, *0.1.

impact the results through the application of an innovative instrumental variable developed by Lange and Sommerfeld (2024). All variables used for the models of Table 4 that are different from those employed for the models of Table 3 are described at the end of Table 1, with basic statistics provided at the end of Table 2. All models collected in Table 4 use the traditional building permit rate (*prm_12*) as the dependent variable. They cover the time period 2013–18, instead of the years 2011–19, as do the models reported in Table 3.

Our first results (Figure 4) pertain to a model that follows in its structure Model 2 of Table 3 and is a counterpart to Model 1 of Table 4, with the difference that variable log(*regf_infl*) is replaced by interactions with the time fixed effects variable *year*. Figure 4 corresponds to Figure 2. The difference between Figures 2 and 4 lies in the fact that Figure 4 is based on (a) a different refugee variable (*refg_infl*), (b) a shorter time frame (2013–2018), and (c) the addition of two control variables. The first control variable is a time-varying 0/1 indicator for the presence of initial refugee reception facilities (*EAE*) within a county. The presence of such a facility is expected to draw a larger number of refugees to a county. The second variable (*military*) is time-invariant and provides the number (0–5) of empty military installations (typically barracks) that could be used to house refugees. Again, counties with such unused military facilities can be expected to draw more refugees. We employ the variable *military* for the construction of 5 additional interaction series with our time fixed effects variable *year*.

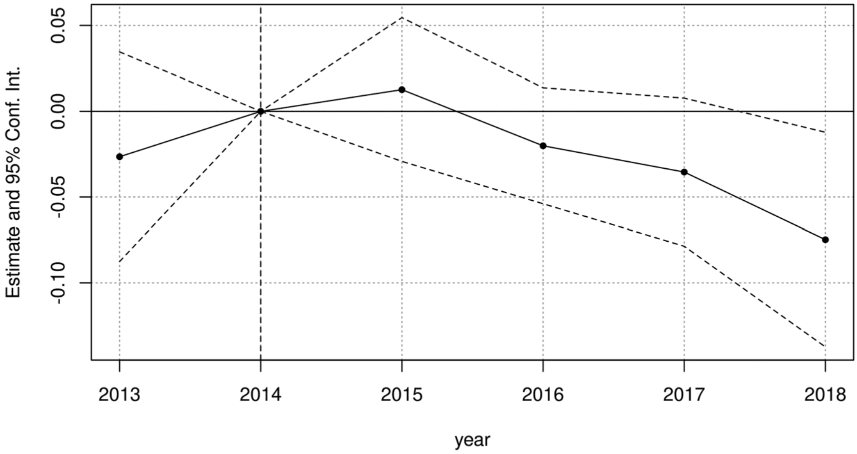

Figure 4: Refugee variable *refg_infl* interacted with *year* time fixed effects; analogous to Table 3, Mod. 2 (alternative to Table 4, Mod. 1, with log(*refg_infl*) replaced by *year* interactions, *prm_12*).

The response pattern of the elasticity values in Figure 4 is noticeably similar to that of Figure 2. The key take-away is that the percentage response of building permits to a given percentage rise in refugee inflows is negative after 2015 and increases in absolute terms over time. The response pattern of Figure 4 confirms the earlier result that building permits have become more sensitive to refugees after the refugee surge and that this sensitivity gained momentum over time instead of being of a temporary nature.

Model (1) of Table 4 gives the point estimate of β_0 in Equation (2) in the absence of a coefficient β_1. At –0.03, it represents the average elasticity of building permits with respect to refugees before, during, and after the refugee surge. It is not statistically different from zero at standard levels of confidence. Model (2) of Table 4 allows the building permit elasticity to vary before and after the refugee surge according to Equation (2). This results in two elasticity estimates, one for the time period from 2013 to 2015 and one for the time period from 2016 to 2018. The first of these elasticities is zero, and the second one has a value of –0.045 and is statistically significant at the 10 percent level. This value is only about half the elasticity estimate of the corresponding Model (4) in Table 3. One reason for this discrepancy is the shorter time horizon that is employed for the estimation of the models in Table 4; it does not allow for capturing the full momentum of the sensitivity of building permits to refugees shares.

Model (3) in Table 4 does not use any 0/1 indicator variables to separate between before and after the refugee shock of 2015/16. Instead, it instruments variable *refg_infl* with the number of *ex ante* predicted refugees, a variable designed for and implemented in another context by Lange and Sommerfeld (2024). The resulting elasticity estimate more than doubles in absolute size to –0.07 from a value of –0.03 in Model (1). It also switches from being statistically insignificant to being highly significant. The IV estimate of the refugee variable means that a doubling of the refugee inflow lowers standard building permits by about 7 % over the estimation period from 2013 to 2018. Comparing the estimate to those shown in Table 3, we see that the instrumentation in Model (3) makes the building permit elasticity very similar to the ones predicted by Models (3) and (4) of Table 3 for the time period after the refugee surge. The first-stage estimates of Model (4) in Table 4 confirm that the IV estimates are statistically acceptable in the sense that we do not have a weak instrument problem.[9] The instrumental variable is statistically significant as reflected in the corresponding F-test statistic.

9 To save space, we report individual coefficients of the first stage estimates only for those variables that are statistically significant in either Model 3 or in Model 6 of Table 4.

Models (4)–(6) of Table 4 replicate Models (1)–(3) for the refugee variable used for the estimates presented in Table 3. This makes it possible to assess what difference the choice of the refugee variable makes for the results.

The results of Model (4) confirm those of Model (1) that the average building permit elasticity with respect to refugees over the years 2013–2018 is not statistically different from zero at common levels of confidence. If one allows the elasticity to be different before and after 2016, as in Model (5), the elasticity value for the years 2016–2018 turns out to be −0.086, which is statistically highly significant and almost twice the value derived for Model (2). It is in fact close to the elasticity value generated in Model (3) by IV estimation. Model (6) shows the IV estimates that correspond to Model (3). The estimated elasticity with respect to the refugee share log(*refg*) is not different from zero statistically. From the first-stage results, we can see that this is the result of a week instrument problem. The corresponding *F*-statistic is not statistically significant at any common level.

Comparing the estimates from Models (1)–(3) to those of Models (4)–(6), we note that the definition of the refugee variable matters for the IV estimators. Outside of those, the results are rather similar. In addition, the IV estimates of Model (3) in Table 4 tend to be fully consistent with the OLS estimates shown in Table 3 if one is willing to assume that the refugee surge of 2015/16 played a critical role in the increased sensitivity of building permits to refugees after 2015.

4 Conclusions

Prior studies have provided evidence on a causal impact of immigration or refugee inflows on housing markets. These are available for countries other than Germany. An entirely different strand of the literature has investigated the impact of the 2015/16 refugee surge on crime and economic activity in Germany. This paper combines these two strands to examine to what extent the 2015/16 refugee surge in Germany had an impact on residential building permits. Of key interest to us in this context is the question whether any impact, if indeed there is one, was only temporary or longer lasting.

Based on our annual panel data set on German counties from 2011 to 2019 and an alternative data set covering the years 2013–2018, we conclude that, conservatively estimated, a doubling of the population's refugee share likely triggered a drop in the permit rate for single- and two-family housing by 7 %–9 % over the years 2017–2019. From the dynamics of the response pattern of the elasticity of building permits with respect to refugees, we can safely conclude that building permits did not materially respond to refugees prior to the refugee surge of 2015/16. After 2015, the responsiveness of building permits to refugees gained momentum and became statistically significant. From the dynamics of the response pattern, we can rule out temporary administrative issues associated with overwhelmed building authorities as the proximate cause. The elasticity of building permits with respect to refugees remains negative and statistically significant to the end of our sample. This suggests that the supply of new one- or two-family housing was held back more than temporarily in areas with a surge in refugees. This is an unintended consequence of taking in a large number of refugees. For a country with a dearth of new housing, it is unfavorable news.

Given the limited scope of our study, we cannot supply evidence on why traditional building permits became (more) responsive to the share of refugees after the 2015/16 refugee surge. However, based on what has been observed in studies on the response of real estate markets to sizable refugee concentrations in other countries, we can suggest a hypothesis: potential homeowners may have become (more) sensitive to the presence of refugees in planning or building new homes after 2015/16. This may be tied to a feeling of uncertainty or unease about the future. What could make this response pattern to some degree plausible is (a) the unprecedented size of the 2015/16 refugee wave and (b) the fact that the 2015/16 refugees were disproportionately young, single males with a very different cultural background. We believe it would be interesting to pursue such a hypothesis in future research work to check whether behavioral patterns observed in the real estate markets of other countries also apply to Germany.

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References

Berbée, Paul, Herbert Brücker, Alfred Garloff, and Katrin Sommerfeld. 2022. “The Labor Demand Effects of Refugee Immigration: Evidence from a Natural Experiment.” IZA Discussion Paper No. 15833. https://doi.org/10.2139/ssrn.4312452.

Dehos, Fabian T. 2021. “The Refugee Wave to Germany and its Impact on Crime.” *Regional Science and Urban Economics* 88: 103640.

Entorf, Horst, and Martin Lange. 2023. “Refugees Welcome? Understanding the Regional Heterogeneity of Anti-Refugee Hate Crime.” *Regional Science and Urban Economics* 101: 103913.

Fremerey, Melinda, Lukas Hörnig, and Sandra Schaffner. 2024. “Becoming Neighbors with Refugees and Voting for the Far-Right? The Impact of Refugee Inflows at the Small-Scale Level.” *Labour Economics* 86: 102467.

Gehrsitz, Markus, and Martin Ungerer. 2022. “Jobs, Crime and Votes: A Short-Run Evaluation of the Refugee Crisis in Germany.” *Economica* 89 (355): 592–626.

Gonzalez, Libertad, and Francesc Ortega. 2013. "Immigration and Housing Booms: Evidence from Spain." *Journal of Regional Science* 53 (1): 37–59.

Jeanty, P. Wilner, Mark Partridge, and Elena Irwin. 2010. "Estimation of a Spatial Simultaneous Equation Model of Population Migration and Housing Price Dynamics." *Regional Science and Urban Economics* 40 (5): 343–52.

Lange, Martin, and Katrin Sommerfeld. 2024. "Do Refugees Impact Crime? Causal Evidence from Large-Scale Refugee Immigration to Germany." *Labour Economics* 86: 102466.

Lerbs, Oliver W. 2014. "House Prices, Housing Development Costs, and the Supply of New Single-Family Housing in German Counties and Cities." *Journal of Property Research* 31 (3): 183–210.

McGinnis, Harry. 1994. "Determining the Impact of Economic Factors on Local Government Growth Policy: Using Time-Series Analysis and Transfer Function Models." *Urban Studies* 31 (2): 233–46.

Mohammed, Jibrin K., Abdullahi A. Aliyu, Usman A. Dzukogi, and Abdulafeez A. Olawale. 2021. "The Impact of COVID-19 on Housing Market: A Review of Emerging Literature." *International Journal of Real Estate Studies* 15 (2): 66–74.

Mussa, Abeba, Uwaoma G. Nwaogu, and Susan Pozo. 2017. "Immigration and Housing: A Spatial Econometric Analysis." *Journal of Housing Economics* 35: 13–25.

Pavlov, Andrey, and Tsur Somerville. 2020. "Immigration, Capital Flows and Housing Prices." *Real Estate Economics* 48 (3): 915–49.

Rozo, Sandra V., and Micaela Sviatschi. 2021. "Is a Refugee Crisis a Housing Crisis? Only if Housing Supply is Unresponsive." *Journal of Development Economics* 148: 102563.

Sá, Filipa. 2015. "Immigration and House Prices in the UK." *The Economic Journal* 125 (587): 1393–424.

Saiz, Albert. 2007. "Immigration and Housing Rents in American Cities." *Journal of Urban Economics* 61 (2): 345–71.

Tumen, Semih. 2016. "The Economic Impact of Syrian Refugees on Host Countries: Quasi-Experimental Evidence from Turkey." *The American Economic Review* 106 (5): 456–60.

Van Vuuren, Aico, Josef Kjellander, and Viktor Nilsson. 2019. "Refugees and Apartment Prices: A Case Study to Investigate the Attitudes of Home Buyers." *Regional Science and Urban Economics* 77: 20–37.