Local Labor Markets and the Persistence of Population Shocks: Evidence from West Germany, 1939-70*

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Abstract. This paper studies the persistence of a large, unexpected, and regionally very unevenly distributed population shock, the inflow of eight million ethnic Germans from Eastern Europe to West Germany after World War II. Using detailed census data from 1939-1970, we show that the shock proved persistent within local labor markets, but was largely reversed between labor markets. These results show that the choice of spatial units can significantly affect the estimated persistence of population shocks. They can thus help to explain why previous studies on the persistence of population shocks reached conflicting conclusions.

Keywords: Population shock, locational fundamentals, agglomeration economies, regional migration, postwar Germany.
JEL Classification: J61, R12, R23, N34.

This is a pre-copyedited, author-produced version of an article accepted for publication in *Journal of Economic Geography* following peer review. The version of record, "Sebastian T Braun, Anica Kramer, Michael Kvasnicka, Philipp Meier (2021). Local labor markets and the persistence of population shocks: evidence from West Germany, 1939–1970. *Journal of Economic Geography* 21(2): 231-260," is available online at: https://doi.org/10.1093/jeg/lbaa013.

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*This paper has benefited from comments by Thomas Bauer, Hartmut Egger, Dávid Krisztián Nagy, Frédéric Robert-Nicoud, Marc-Philipp Saur, two anonymous referees, seminar participants at the University of Bayreuth and RWI Essen, and conference participants at the 2018 AEA Annual Meeting, the 2017 EALE Conference, the 2016 RGS/RWI Workshop on the Economics of Migration, and the 2016 Spring Meeting of Young Economists. Christian Kagerl, Kathleen Kürschner, Yue Huang, and Anja Rösner have provided valuable research assistance in collecting and processing various historical data for different sub-national administrative regions in Germany. The research in this paper was funded by Deutsche Forschungsgemeinschaft (project number 267108021, "Die volkswirtschaftlichen Effekte der Vertriebenen und ihre Integration in Westdeutschland, 1945-70"). Any remaining errors are our own.

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1 Introduction

We study the persistence of a very large population shock, the inflow of eight million displaced Germans (expellees) from Eastern Europe to West Germany after World War II. This population shock hit West German counties very unequally, with expellee inflow rates ranging from 1.4% of the pre-war population to as much as 83%. We show that this migration-induced regional population shock had a persistent effect on the distribution of population *within* labor markets, but was largely reversed *between* labor markets.

Our findings can help to explain the disparate results in the growing empirical literature on the persistence of population shocks. This literature exploits population shocks to gauge the relative importance of the two main explanations put forward for the spatial distribution of economic activity, locational fundamentals and increasing returns.[1] The locational fundamentals theory holds that long-lasting geographic conditions, such as access to a river, determine the spatial distribution of economic activity. Consequently, shocks to the spatial distribution of population should have only temporary effects on regional population patterns. The increasing returns theory, in contrast, suggests that population density itself may enhance productivity because of agglomeration economies. According to this second theory, shocks to the distribution of economic activity could well have long-run consequences if they are large enough to shift the economy from one equilibrium to another (see Henderson, 1974; Krugman, 1991, for seminal theoretical contributions).

Empirical studies that exploit exogenous population shocks to explore these explanations have produced diverging results.[2] A first set of studies shows that bombings during World War II had no persistent effect on city size in Japan (Davis and Weinstein, 2002) and West Germany (Brakman et al., 2004). Furthermore, Davis and Weinstein (2008) find that the industrial structure of Japanese cities also recovered quickly to its pre-war pattern. The findings of this first set of studies provide empirical support for the locational fundamentals theory, which predicts that temporary shocks have only temporary effects. A distinctive feature of these studies is that they typically use larger cities as their unit of observation.[3] This is of importance for the argument developed in this paper, since larger cities are usually located in different regional labor markets.

A second set of studies, in contrast, finds that migration-induced population shocks during and after World War II were highly persistent. Sarvimäki (2011) shows that the inflow of forced migrants into rural areas of Finland had a re-inforcing effect on post-war population growth, and Schumann (2014), focusing on the West German state of Baden-Württemberg, shows that expellee inflows had a persistent effect on municipality size. Similarly, Eder and Halla (2016) find that inner-Austrian migration out of the (temporary) Soviet occupation zone still affects the spatial distribution of population in Austria today. The findings of this second set of studies hence suggest that locational fundamentals do not determine long-run population

[1] See Redding (2010) for a general overview of the existing empirical literature on new economic geography, including the empirical approaches to distinguish between locational fundamentals and increasing returns.

[2] Disentangling locational fundamentals and economies of scale is empirically challenging. This is because locational fundamentals are long-lasting and may have promoted economies of scale later on, and because exogenous changes in locational fundamentals are extremely rare. Exploiting exogenous population shocks is thus a popular identification strategy for dinstiguishing between increasing returns and locational fundamentals. Bleakley and Lin (2012) is a prominent exception in this regard. The authors exploit the fact that a natural advantage, namely portage sites, became obsolete over time. Their results support agglomeration effects and path dependency: Even after portage sites lost their function for transportation, cities along these places grew faster.

[3] Miguel and Roland (2011) is an exception in this regard. The authors use district-level data to show that US bombing during the Vietnam War had no long-run effect on later economic development in Vietnam.

patterns.

We contribute to this empirical literature by studying the persistence of a major population shock, the inflow to West Germany of German expellees from Eastern Europe after World War II.[4] Two features make the historical episode particularly well suited for our analysis. First, the inflow was not only large, increasing West Germany's population from 39 million in 1939 to 48 million in 1950, but also very unequally distributed across West German counties. Second, the initial allocation of expellees was driven by the availability of housing and the geographic distance between origin and destination regions, not by economic fundamentals. In particular, we show that conditional on control variables for the local housing supply, the distribution of expellees was unrelated to pre-war trends in population growth.

We show that the choice of the regional unit of observation and the type of variation exploited, so far largely ignored in the literature, are vital for the estimated persistence of the population shock. Specifically, we find that expellee inflows had a persistent effect on the spatial distribution of population within local labor markets. In contrast, the inflows had little effect on the distribution between labor markets, as population growth in 1950-70 reversed much, though not all, of the initial population shock.

We interpret our findings in the light of the classic monocentric land use theory, developed by Alonso (1964), Mills (1967) and Muth (1969). We think of labor markets as functional geographic areas, in which workers commute from the periphery to an urban core. Two empirical observations guide our interpretation: First, expellee inflow rates were considerably larger in the periphery of labor markets than in their core. Second, inflows induced the construction of local roads. The monocentric model predicts that better transport infrastructure decreases the share of population living close to the labor market core, i.e., fosters suburbanization, and increases the overall population of a labor market. Our empirical findings are consistent with these two predictions. We argue that road infrastructure investments increased the equilibrium size of labor markets but were not large enough for them to fully absorb expellee inflows. Consequently, migration from high- to low-inflow labor markets reversed much, though not all, of the initial population shock between labor markets. Within labor markets, road infrastructure investments induced suburbanization. Since expellees were already over-represented in the periphery, their inflow did not necessitate re-adjustment within labor markets. To put it differently, the spatial distribution of population after the expellee inflow was consistent with the (post-migration) equilibrium within but not between labor markets.

Our basic point is thus simple: empirical studies on the persistence of population shocks should carefully explain whether they consider the (determinants of) spatial equilibrium within or between geographic areas to facilitate cross-study comparisons. Results from inter-city regressions, for instance, are not directly comparable to those from intra-city regressions, as the relevant determinants of spatial equilibrium are likely to differ.[5] This general insight can help to explain the diverging results in the existing literature on the persistence of population shocks.[6] To illustrate, consider the aforementioned study by Schumann (2014) who

[4]Previous studies have exploited regional variation in expellee inflow rates to analyze the short-run effect on native employment (Braun and Omar Mahmoud, 2014) and structural change (Braun and Kvasnicka, 2014), the dynamic response of local labor markets (Braun and Weber, 2016), and the effect on productivity and regional economic development (Peters, 2017).

[5]Duranton and Puga (2015) make this distinction very explicit in their discussion of the effect of transport infrastructure in the urban growth literature. In particular, they distinguish between the effect on inter-city population growth and the effect on intra-city suburbanization.

[6]Our findings complement previous arguments by Schumann (2014) who suggests that locational fundamentals might be par-

also focuses on the inflow of expellees to West Germany after World War II. Schumann (2014) restricts the analysis to one federal state, Baden-Württemberg. After the war, Baden-Württemberg was temporarily divided into two occupation zones, a French and an American zone. Expellees were initially not resettled into the French zone of occupation, which created a sharp discontinuity at the border to the American zone of occupation. Schumann (2014) shows that this discontinuity is still visible 25 years after the war. Importantly, however, municipalities along the occupation zone border often belonged to the same local labor market. Schumann thus effectively exploits only variation *within* local labor markets.

Unlike Schumann, our analysis considers the whole of West Germany and exploits variation in expellee inflows not only within but also between local labor markets. When we exploit only variation within local labor markets, we confirm the results Schumann obtained for municipalities in Baden-Württemberg. However, and importantly, we also show that his results do not carry over to population patterns *between* local labor markets. At this more aggregated regional level, population patterns quickly revert back towards their pre-war level. Our preferred estimate suggests that 83% of the initial shock is dissipated 25 years after the war. The finding highlights the crucial relevance of the choice of the regional unit[7] and the type of variation exploited in the analysis for the estimated persistence of a population shock.

Our findings are also relevant for the literature that studies the effect of immigrant inflows on population outflows. This literature has not yet reached a definite conclusion: Some studies find that immigrant inflows lead to native outflows (Borjas, 2006; Boustan et al., 2010), whereas other studies find no such link (Card and DiNardo, 2000; Card, 2001). Using net migration as an additional outcome variable, we show that variation in expellee inflows between but not within local labor markets is negatively associated with net population flows, mirroring our results for population growth. Since expellees were more likely to migrate than natives (Bauer et al., 2013; Braun and Weber, 2016), they are likely to have contributed disproportionally to these migration flows.

The paper proceeds as follows. Section 2 provides background information on the expellee inflow to West Germany after World War II. Section 3 describes the various data sources and the identification strategy we use in our empirical analysis. Section 4 presents our regression results. Section 5 interprets our findings. Finally, Section 6 summarizes our main findings and concludes.

2 Historical Background

After World War II, West Germany experienced the inflow of eight million expellees (*Heimatvertriebene*), most of them from the ceded eastern provinces of the defeated German Reich. The displacement of Germans took place from 1944 to 1950 and occurred in three distinct phases (for further details see, e.g., Connor

ticularly important for geographically diverse countries and for urban areas. Likewise, Sarvimäki (2011) suggests that a population shock may be large enough to change the equilibrium of rural areas "at the brink of becoming a local manufacturing center" (p. 3) but not the equilibrium of well established cities.

[7]The choice of regional unit also conciliates the findings of Schumann (2014) and the results on internal migration in Braun and Weber (2016). The latter develop a two-region search and matching model to analyze how regional labor markets adjusted to the expellee inflow, and show that migration from high- to low-inflow regions was an important channel of adjustment. The result appears to contradict Schumann who finds no evidence for major outflows from the high-inflow American occupation zone. The different units of observations can explain these seemingly disparate findings: While Schumann (2014) studies small municipalities located close to each other, Braun and Weber (2016) divide West Germany in their analysis in only two large regions.

(2007), Douglas (2012), and Schulze (2011)). The first phase began in 1944, when hundreds of thousands of Germans from the eastern provinces of the German Reich fled from the approaching Red Army. Most of these refugees planned to return home after the end of the war, and therefore fled to the nearest West German regions. After Nazi Germany's unconditional surrender in May 1945, Polish and Czech authorities began to drive their remaining German populations out. These so-called wild expulsions, which constituted the second phase of the displacement, were not yet sanctioned by an international agreement. The third phase began after the Soviet Union, the United Kingdom, and the United States signed the Potsdam Agreement in August 1945. The Potsdam Agreement shifted Germany's eastern border westwards to the Oder-Neisse line. The former eastern provinces of the German Reich were placed under Polish or Russian control (see Figure 1). Germans remaining east to the new border were brought to post-war Germany in compulsory and organized transfers. The German territory west to the Oder-Neisse line was divided into four occupation zones: a British, a French, an American, and a Soviet zone.

Overall, the mass exodus of Germans from East and Central Europe involved at least 12 million people. Most expellees re-settled in West Germany. By September 1950, expellees accounted for 16.5% of the West German population.[8] However, the population share of expellees differed greatly across West German counties, ranging from 1.8% in Pirmasens to 41.4% in Goslar. Our empirical analysis will exploit this pronounced regional variation, which we will now discuss in greater detail along with its underlying reasons.

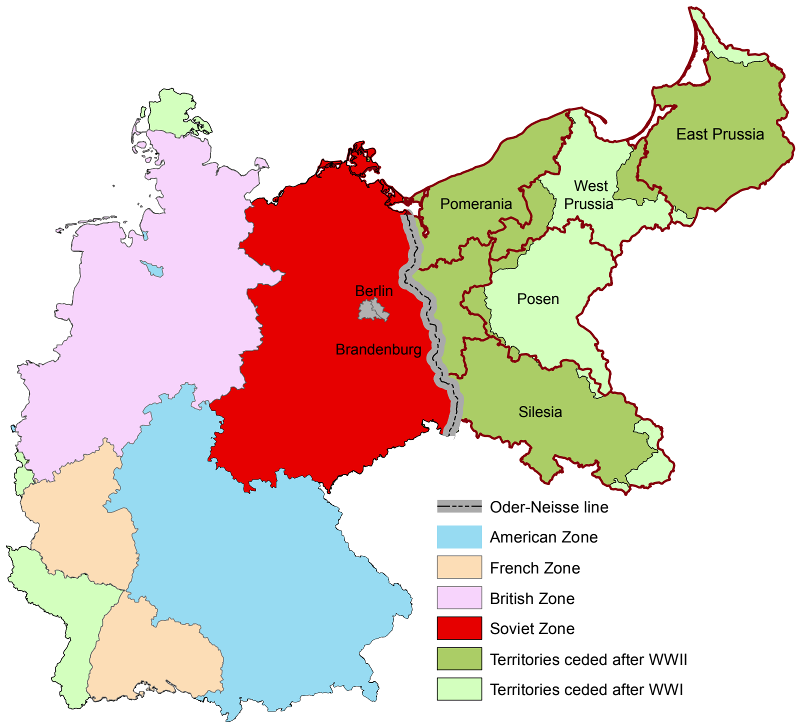
Regional Distribution: Figure 2a illustrates the immigration-induced increase in population across counties, as measured by the number of expellees in 1950 over the population in 1939 (henceforth, expellee inflow rate). This figure provides three main insights. First, there were large differences in the expellee inflow rate *between* occupation zones. In particular, the rate was much higher in the American zone (30.2 %) and British zone (31.4%) than in the French zone (7.5%). This is because the French initially refused to accept any expellees in their occupation zone. The French felt not bound by the Potsdam Agreement, as they had not been invited to the Potsdam conference. As a result of the French refusal, expellees were initially transferred only to the American and British occupation zones in the third phase of the displacement. This created a sharp discontinuity in expellee inflow rates at the border between the American and French zones of occupation, as illustrated in greater detail in Figure 2b. It is this sharp discontinuity that Schumann (2014) exploits to estimate the persistence of the expellee inflow on the spatial distribution of population in parts of Baden-Württemberg.[9]

Second, the population share of expellees also differed greatly *within* occupation zones. This is particularly evident for the British zone where the expellee inflow rate ranged from 4.0% in the western county of Bocholt to 83.5% in the north-eastern county of Eckernförde. This west-east divide was a result of the largely undirected flight of Germans during the final stages of the war (the first phase of the displacement). As the Soviet troops pushed westwards, Germans residing in the eastern provinces of the German Reich

[8]Most expellees arrived until 1946. In the October 1946 census, the first one conducted after World War II, the number of expellees registered already accounts for 76% of the respective expellee total recorded in the September 1950 census.

[9]In related recent work, Wyrwich (2020) studies the long-run effects of the French occupation zone on population growth. He documents that regions in the French occupation zone saw lower growth in 1939-2010 compared to regions in the American or British zone, a finding that the author attributes to the French refusal to accept expellees in their zone of occupation.

FIG. 1: The Division of Germany and German Territorial Losses after World War I and II



Source: Own illustration. *Basemap*: MPIDR (2011).

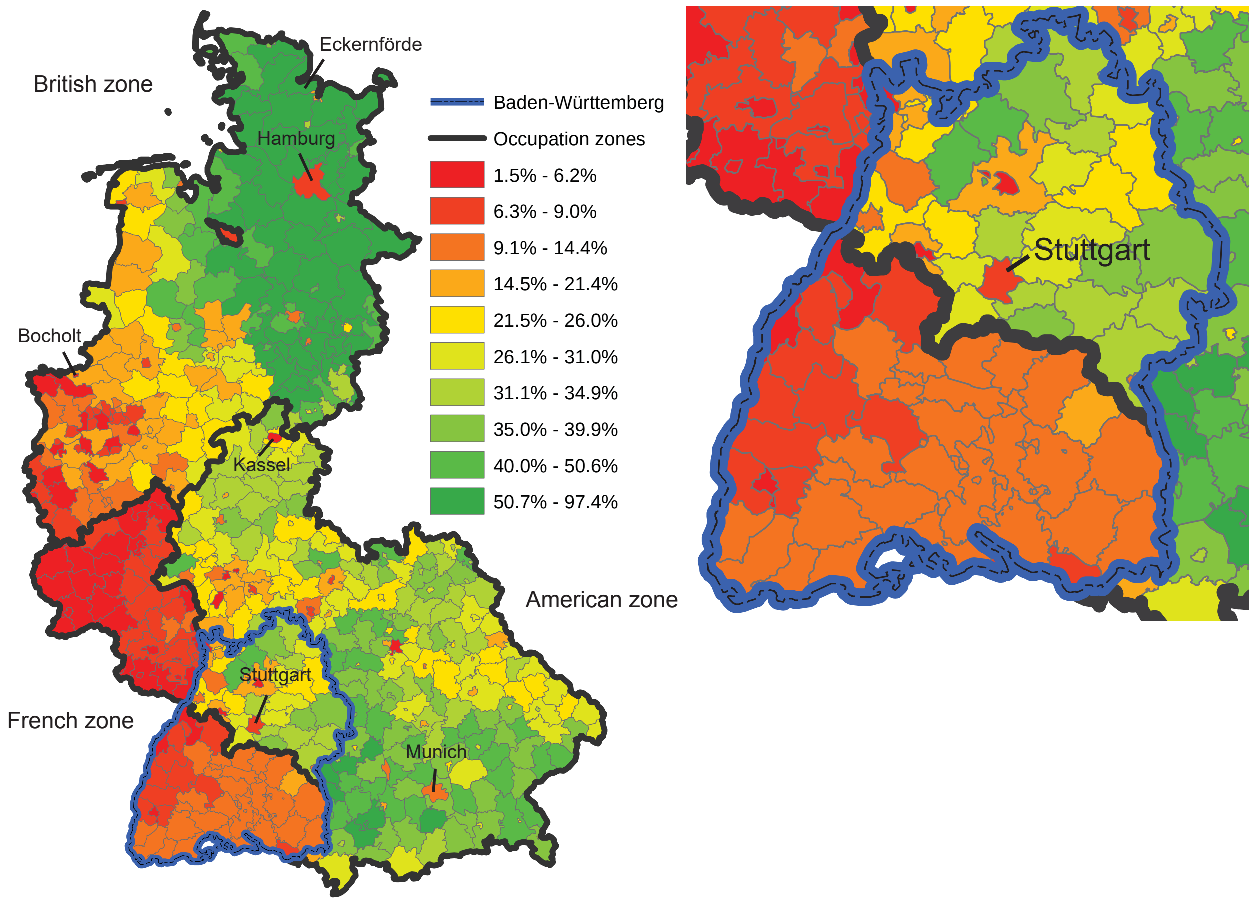
were forced to seek shelter further west. The refugees thus crowded in the most accessible regions in the west and north-west of West Germany. Refugees from East Prussia, for instance, mostly ended up in the northern state of Schleswig-Holstein, as East Prussia and Schleswig-Holstein were connected via the Baltic Sea. The wild expulsions (second phase of the displacement) only added to the regional imbalance between counties in the west and east, as Polish and Czech authorities often just drove Germans across the border into occupied Germany. Many Germans from the Sudetenland, for instance, were forced into neighboring Bavaria.

Third, the population share of expellees also differed systematically between cities and surrounding rural areas. Figure 2b highlights the example of the city of Stuttgart. While the expellee inflow rate was only 8.5% in Stuttgart, it ranged from 27.3% to 31.7% in the five immediately neighboring rural counties. Similar patterns can be observed for other cities such as Hamburg in the north, Kassel in the center, and Munich in the south of Germany. Expellees were generally more likely to be placed in rural areas, where the housing stock had remained largely intact during the war (Connor, 2007).

Recapitulating the above, the historical setting we explore provides rich spatial variation in expellee inflows rates. Expellee inflow rates differed both *between* counties far away from each other–for instance, between counties located in the west and the north of Germany–and between neighboring counties–for instance, between neighboring counties at either side of the French occupation zone border. The average inflow rate across all counties was 0.270, with a standard deviation of 0.176.

FIG. 2: Expellee Inflow Rates

(a) West Germany (b) Baden-Württemberg



Notes: The figures depicts the number of expellees per county on 13 September 1950 over the population per county on 1 September 1939 in West Germany (panel 2a) and the state of Baden-Württemberg (panel 2b). The black line depicts the border of the three occupation zones. The blue line, which partly overlaps with with the black line, depicts the border of the West German state of Baden-Württemberg.
Source: Statistisches Bundesamt (1952). *Basemap*: MPIDR (2011).

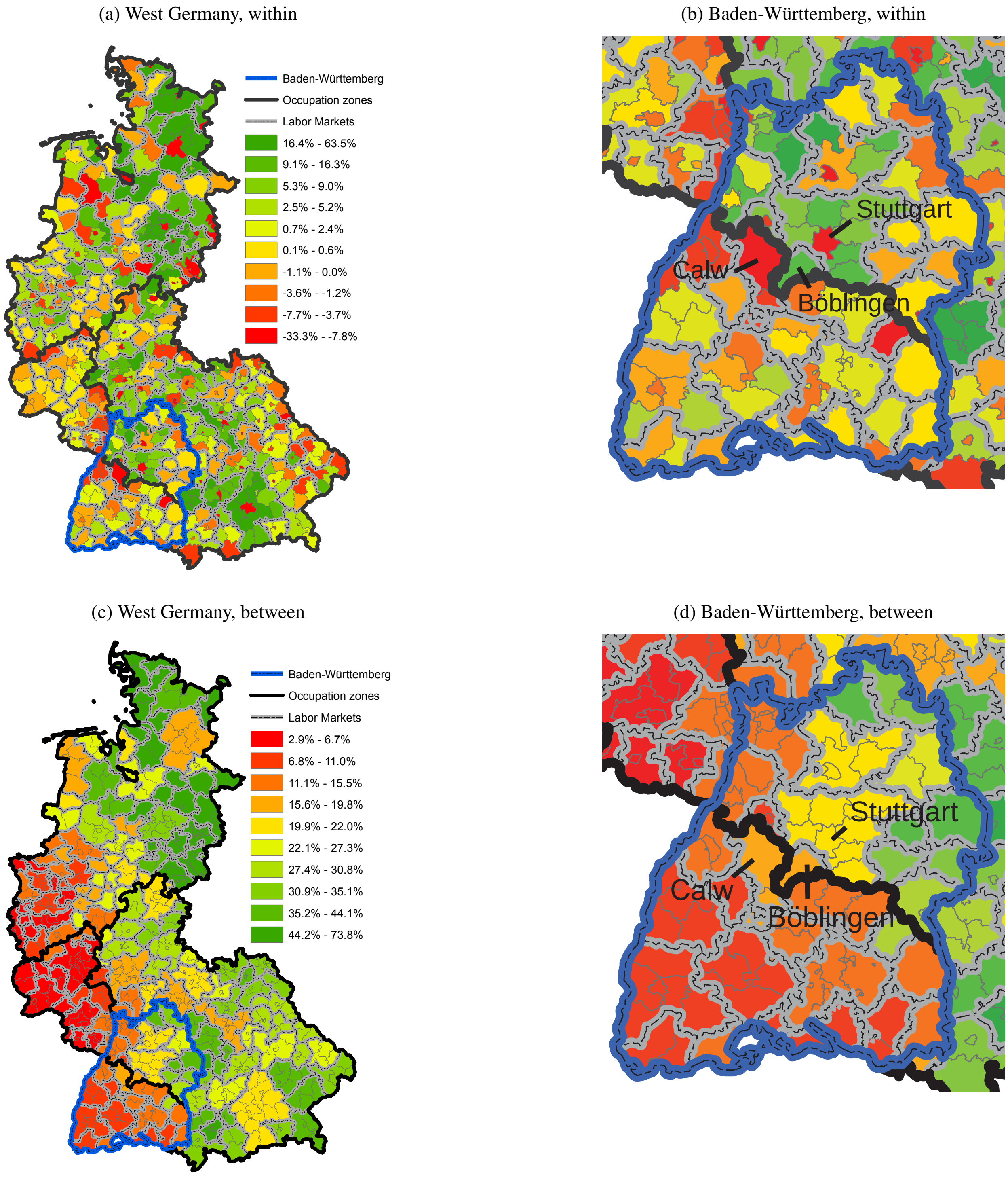
Variation Between and Within Local Labor Markets: The labor markets of neighboring counties are often well connected through commuting flows, and several counties typically form one local labor market. Based on commuting flows, IfW (1974) defines 164 labor market regions, each consisting of an average of 3.4 counties.[10] Expellee inflow rates in our setting differ greatly both *within* and *between* these local labor markets. To show this, we decompose the overall variation in expellee inflow rates. Let I_{ij} be the expellee inflow rate for county i located in labor market j. We decompose I_{ij} into a between component, $\bar{I}_j$, and a within component, $I_{ij} - \bar{I}_j$. The between component is simply the expellee inflow rate measured at the level of local labor market j, while the within component is the difference between the inflow rate of a particular county i in labor market j and the inflow rate of labor market j.

Figure 3a illustrates for West German counties the within component, i.e., the variation in expellee inflow rates across counties located in the same labor market region. The within component ranges from -0.333 to 0.635 with a standard deviation of 0.112. Zooming in to the state of Baden-Württemberg, Figure 3b illustrates that the within-labor-market variation comes from three sources. First, the borders of local labor markets (the dashed black line on grey ground in the figure) frequently spanned counties from both sides of the French occupation zone border, and these counties typically experienced very different inflow rates. The counties of Calw and Böblingen, for instance, were both part of the same labor market but their inflow rates differed greatly. Whereas the inflow rate of Calw stood at 8.7% in 1950, the inflow rate of Böblingen was 30.5% (see Figure 3b). The inflow rate in Calw, therefore, was significantly below the inflow rate of the local labor market in which it was situated. Second, local labor markets frequently consisted of both a larger city, typically with low expellee inflow rates, and surrounding hinterlands, with larger inflow rates. The city of Stuttgart is a case in point (see again Figure 3b). Third, variation in expellee inflow rates within local labor markets also reflected the east-west or north-south gradient in inflow rates, although this variation was typically more modest between neighboring counties.

In addition to this variation within local labor markets, there was also sizeable variation in expellee inflow rates between local labor markets. Figure 3c illustrates this between component of the total variation in expellee inflow rates for West Germany. The between component varies between 0.029 and 0.738, with a mean of 0.257 and a standard deviation of 0.162. The figure shows that much of the variation in the between component came from the stark difference between local labor markets in the north and east of the country and those in the west and south-west. As noted before, this east-west divide was mostly the result of the largely undirected flight to the most accessible West German regions at the end of World War II; and it was reinforced by the French refusal to allow any expellees into their occupation zone in the south-west of Germany. Importantly, however, Figure 3d, which zooms in to the state of Baden-Württemberg, shows that the sharp discontinuity of expellee inflow rates at the French occupation zone largely disappears when inflow rates are calculated at the level of local labor markets. This is mainly because some labor markets spanned counties from both sides of the occupation zone border. Moreover, the low inflow rate into Stuttgart counter-balanced the high inflow rates of counties in its hinterland, including those at the occupation zone border.

[10] To the best of our knowledge, the definition in IfW (1974) is the earliest definition of local labor markets in West Germany. A few counties belong to more than just one local labor market. In this case, we assign the county to the labor market with which it shares the larger area.

FIG. 3: Variation in Expellee Inflow Rates Within and Between Labor Markets



Notes: The figures depict the number of expellees per county on 13 September 1950 over the population on 1 September 1939 per county in West Germany (panels 3a and 3c) and in the state of Baden-Württemberg (panels 3b and 3d). The upper two panels calculate figures at the level of counties, the lower two panels at the level of local labor markets. The solid black line depicts the borders of the three occupation zones, the dashed black line on grey ground depicts the borders of local labor markets, and the blue line, which partly overlaps with the black line, depicts the border of the West German state of Baden-Württemberg.
Source: Statistisches Bundesamt (1952). *Basemap*: MPIDR (2011).

3 Empirical Strategy

We exploit regional variation in expellee-induced population increases across West German counties. We use West German counties in their 1970 borders.[11] As major changes to county borders occurred in the 1970s, we also confine the period of analysis up to that year.[12] Our main data sources are the population and occupation censuses of 1939, 1946, 1950, 1961 and 1970 which we have digitalized for our analysis. Appendix G provides a detailed overview of the data sources for all variables.

Within and Between Regressions: We begin by estimating the following OLS regression:

$$G_{ij}^{70,50} = \alpha_1 + \beta_1 I_{ij}^{50,39} + X_{ij}\gamma_1 + u_{ij}, \tag{1}$$

where $G_{ij}^{70,50}$ is the population change in 1950-70 over the population in 1939 of county i in labor market j (henceforth: population growth in 1950-70), $I_{ij}^{50,39}$ is the expellee inflow rate of county i between 1939-50, X_{ij} is a vector of covariates, and u_{ij} is an error term.[13] The regression tests whether expellee-induced population growth in 1939-50 reduced or reinforced population growth in 1950-70. The former case is typically interpreted in the literature as evidence for the importance of locational fundamentals, the latter as evidence for the importance of agglomeration economies. Specification (1) mimics the conventional approach in the literature (see, for instance, Sarvimäki, 2011; Davis and Weinstein, 2002) to test whether shock-induced population growth in one period affects population growth in subsequent (post-shock) periods.

Our key hypothesis is that the persistence of expellee-induced population growth will differ depending on the type of variation we exploit in the empirical analysis. We thus run two additional specifications in which we only exploit variation within or between local labor markets:

$$\text{Within:} \quad (G_{ij}^{70,50} - \bar{G}_j^{70,50}) = \beta_2(I_{ij}^{50,39} - \bar{I}_j^{50,39}) + (X_{ij} - \bar{X}_j)\gamma_2 + (u_{ij} - \bar{u}_j), \tag{2}$$

$$\text{Between:} \quad \bar{G}_j^{70,50} = \alpha_3 + \beta_3 \bar{I}_j^{50,39} + \bar{X}_j\gamma_3 + \bar{u}_j, \tag{3}$$

where $\bar{Z}_j$ denotes the value of variable Z for local labor market j. Specification (2) considers deviations from labor-market-wide levels, and thus exploits only variation between (nearby) counties *within* the same local labor market. Specification (3) aggregates the county-level data to the level of local labor markets, and only uses the variation *between* (more distant) local labor markets in West Germany. The between specification differs from Specification (1) in the choice of the regional unit considered: The former studies local labor

[11] There are 548 counties in 1970. However, a few of them experienced changes in their administrative borders between 1939 and 1970. While population data for 1939, 1950 and 1970 are available for counties in their 1970 borders, some of our control variables refer to counties in their 1939 or 1950 borders. We account for border changes between 1939 and 1970 by merging counties so that county borders are generally comparable over time (see Appendix F for the details). This leaves us with 511 counties. Counties located in the states of Rhineland-Palatinate and Schleswig-Holstein saw major border changes in 1969/70. For counties located in these two states, we use the administrative borders immediately before the major border changes.

[12] Changes to administrative county borders, mainly in the 1970s, reduced the total number of counties from 548 in 1970 to just 321 in 1987, the year of the first census after the 1970 census we use in our analysis.

[13] We normalize both population change in 1950-70 and expellee inflows by population in 1939 to simplify the interpretation of β_1. In particular, $\beta_1 = -1$ indicates that the expellee-induced population shock is completely reversed by 1970. We show in Section 4.1 that our results are robust to normalizing the dependent variable by population in 1950.

markets, the latter focuses on counties. Our key hypothesis thus states that $\beta_2 \neq \beta_3$.[14]

Identification: Identifying the *causal* effect of population growth on subsequent population growth is challenging because confounding factors may drive population growth in both periods (Davis and Weinstein, 2002; Sarvimäki, 2011). Our empirical exercise isolates variation in wartime population growth that is due to the inflow of expellees. The key identifying assumption for a causal interpretation of β_1, β_2, and β_3 is that there is no unobserved factor that drives both the expellee inflow rate and population growth in 1950-70. In particular, estimates will be upward (downward) biased if expellees systematically selected, based on unobservable characteristics, into West German regions with a higher (lower) underlying potential for population growth.

For several reasons, self-selection of expellees was arguably a minor problem until 1950, when we measure expellee inflows. First, expellees did not choose their initial destination in West Germany based on local economic conditions (which, in turn, are likely to correlate with potential population growth). Expellees initially fled to the most accessible regions in West Germany and were later forcibly transferred to a destination (see Section 2). Second, the military governments of the occupation powers, overburdened by the mass inflow of millions of expellees, did not redistribute expellees according to local economic conditions (Braun and Omar Mahmoud, 2014; Braun and Kvasnicka, 2014). Finally, once expellees were resettled in a destination, they could not just move on by their own choice. The occupying powers enacted severe moving restrictions (Müller and Simon, 1959), so that the initial distribution of expellees proved very persistent in the first years after the war.

Our specific historical context thus limits concerns of endogenous self-selection. However, there are still two main threats to identification. First, while military governments did not allocate expellees according to local economic conditions, the distribution of expellees was not altogether random. Since the main objective of military authorities at the time was to find accommodation for all expellees, expellees were under-represented in urban areas that were devastated by the war and offered only limited housing capacity. If war destruction and urbanization rates had an effect on post-war population growth, coefficients on expellee inflow rates will be biased in unconditional OLS regressions. Second, moving restrictions were gradually phased out by 1949. Some expellees, as a consequence, might have moved endogenously by 1950.

We deal with these threats to identification in two main ways. First, we control for war destruction and urbanization, and for other local characteristics that might have affected population growth. We then show that conditional on these covariates, expellee inflow rates are unrelated to regional population growth before the war. This corroborates our argument that once we condition on urbanization and measures of war destruction, expellee inflows were unrelated to potential population growth. Online Appendix A also shows that differences in pre-war economic characteristics between counties with high and low expellee inflow rates tend to disappear once we control for war destruction. Second, we use the expellee inflow rate between 1939 and 1946 as an instrument for the expellee inflow rate between 1939 and 1950. Since strict restrictions

[14] This hypothesis implies that regression equation (1) is misspecified. In particular, we postulate a regression model in which labor-market wide expellee inflows have a different effect on post-war population growth than deviations from this average, i.e., $G_{ij}^{70,50} = \alpha_1 + \beta_2(I_{ij}^{50,39} - \bar{I}_j^{50,39}) + \beta_3 \bar{I}_j^{50,39} + X_{ij}\gamma_1 + u_{ij}$.

on relocations were still in place in 1946, this IV regression exploits only variation in expellee inflow rates that is attributable to the initial inflow of expellees, and not to subsequent, and potentially endogenous, relocations within West Germany.

Controls: We control for regional characteristics that might have affected expellee settlement patterns and influenced potential population growth. First and foremost, we include various measures of war destruction. War destruction correlates–through the availability of housing–with local expellee inflow rates and might have affected also post-war population growth.[15] We use three different measures of war destruction. As our baseline measure, we consider the share of dwellings built until 1945 that were damaged in the war, using information from the 1950 housing census. Unfortunately, the housing census did not count dwellings that were completely destroyed in the war. The share of damaged dwellings is thus calculated only relative to residential housing that could still accommodate residents in 1950. Our second measure is rubble at the end of the war per capita in 1939, as also used in previous work by Brakman et al. (2004), Burchardi and Hassan (2013) and Braun and Kvasnicka (2014). Unfortunately, data on rubble are only available for the 199 largest West German cities. We aggregated the city-level data to the county level, assuming that smaller municipalities did not suffer any war destruction. The rubble indicator will thus underestimate the extent of war destruction in counties with smaller municipalities. The third measure classifies the loss in housing space in four categories, ranging from 'no losses' (1) to 'very substantial losses' (4). This indicator variable is based on various administrative sources at the national and federal state level.

Second, concerning measures of urbanization, we control for a county's population density in 1939. Urban areas offered less potential for housing expellees, and thus received lower expellee inflows. At the same time, population growth may have systematically differed between rural and urban areas. We also use, as alternative measures of urbanization, the population share living in cities with at least 10,000 inhabitants and dummies for the size of the largest city in the local labor market (for cities populated by 100,000-250,000 and more than 250,000 inhabitants).

A third set of covariates includes variables that proxy pre-war economic conditions. First, we include information on pre-war turnover per worker, sampled from turnover tax statistics. This variable accounts for pre-war differences in economic conditions and development. Second, we include the share of the total workforce in a county that is employed in agriculture in 1939.

Finally, we also include a dummy for counties that are less than 75 kilometers away from the post-war inner-German border. Redding and Sturm (2008) show that cities at the inner-German border generally experienced lower population growth than other West German cities, and attribute this difference to a disproportionate loss in market access for cities at the new border. At the same time, counties at the inner-German border received higher-than-average expellee inflows, due to their proximity to the eastern territories of the German Reich (see Section 2).

Expellee Inflows and Pre-war Population Growth: Before we present our main results, we show that pre-war population growth is uncorrelated with expellee inflow rates once we condition on our set of co-

[15] Heavily destroyed cities, in fact, grew faster after the war (Brakman et al., 2004).

variates. Table 1 presents the results from regressing population growth in 1871-1910, 1910-1939, and 1925-1939 on expellee inflow rates and on our standard set of covariates (Online Appendix D presents the corresponding conditional scatter plots). The coefficient on the expellee inflow rate is not statistically significant in three out of the four regressions, the exception being population growth in 1871-1910 (see column (1)). This positive correlation, however, is driven by just a few outliers that experienced excessive population growth during this phase of rapid industrialization (esp. in the Ruhr area where few expellees arrived). Dropping the 11 counties with annual population growth of above 10%, as done in column (2) of Table 1, causes the estimated coefficient on the expellee inflow to drop sharply from 0.016 to 0.003 and turn statistically insignificant.[16] Overall, therefore, these findings corroborate our identifying assumption that conditional on our covariates, expellee inflow rates do not correlate with a region's underlying population growth.

TABLE 1: Expellee Inflows and Pre-war Population Growth

	1871-1910	1871-1910	1910-1939	1925-1939
	(1)	(2)	(3)	(4)
Inflow Expellees 1950	0.016***	0.003	0.001	0.001
	(0.006)	(0.003)	(0.002)	(0.003)
Observations	511	500	511	466

Notes: The dependent variable in columns (1) and (2) is population growth in 1871-1910, in column (3), population growth in 1910-1939, and in column (4), population growth in 1925-1939. Column (2) excludes the 11 counties with annual population growth of above 10% in 1871-1910. All regressions include our standard set of control variables, i.e., population density in 1939, the employment share in agriculture in 1939, turnover per capita in 1935, the share of damaged dwellings, and a dummy for counties within 75 km of the inner-German border. Data on population in 1925 is missing for counties located in the state of Rhineland-Palatinate. Robust standard errors clustered at the level of local labor markets are reported in brackets. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

4 Results

4.1 Baseline Results

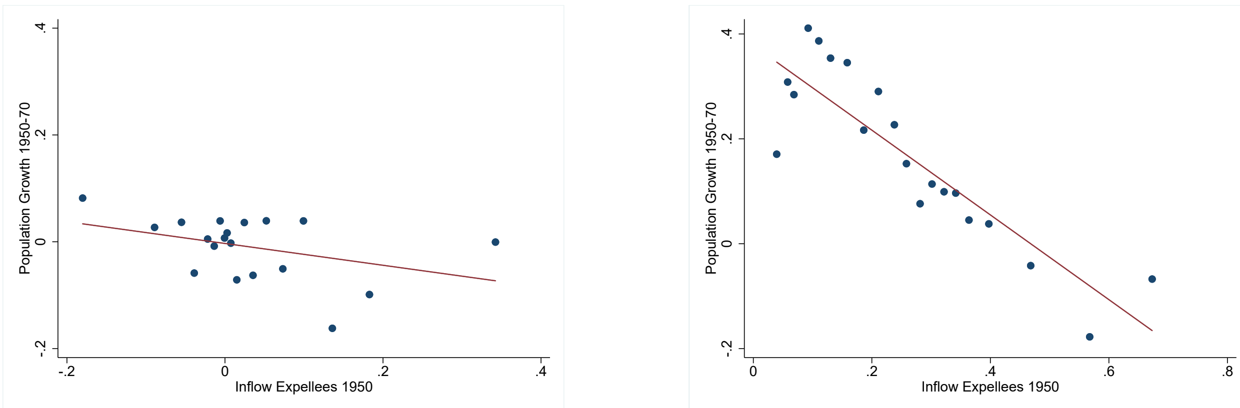
Binned Scatter Plots: We begin by documenting graphically the importance of the two sources of variation exploited in our analysis. Figure 4 depicts unconditional binned scatter plots of population growth in 1950-70 and expellee inflow rates, grouping expellee inflow rates into 20 equal-sized bins. Figure 4a uses only variation within local labor markets, whereas Figure 4b uses only variation between local labor markets. Each scatter plot also shows the respective linear OLS regression line.

Figure 4a shows a weakly negative relationship between the expellee inflow rate and post-war population growth. The binned scatter points are quite dispersed around the regression line, which suggests that its slope is only imprecisely estimated. The estimated OLS slope coefficient is -0.204 with a standard error of 0.834.

[16]The fast-growing counties were typically small in 1871. Weighting the regression in Column (1) by 1871 population halves the coefficient estimate from 0.016 to 0.008.

FIG. 4: Binned Scatter Plots (Unconditional)

(a) Within Local Labor Markets (b) Between Local Labor Markets



Notes: The figures depict binned scatter plots of population growth in 1950-70 and expellee inflow rates, grouping expellee inflow rates into 20 equal-sized bins. Panel 4a relates deviations from labor-market-wide averages to each other, whereas Panel 4b considers labor-market-wide averages themselves.

The unconditional regression thus suggests that expellee-induced population growth had a persistent effect on population patterns within local labor markets, as subsequent population growth did not reverse the initial shock.

This does not imply, however, that there has been no adjustment *between* labor market regions. In fact, Figure 4b shows that local labor markets that exhibited faster (slower) population growth in 1939-1950 grew, on average, less (more) strongly in 1950-1970. The estimated slope coefficient is -0.808 with a standard error of 0.090. This strong and statistically significant negative association is suggestive of significant population adjustments that reversed most of the initial population shock (a coefficient of -1 would indicate complete reversion).

Taken together, Figures 4a and 4b illustrate our main point. The persistence of population shocks might be very different, depending on whether one considers variation within or between local labor markets. In our setting, the within variation points towards a high persistence of population shocks, which, in the relevant literature, is typically interpreted as evidence against the importance of locational fundamentals. The between variation, in contrast, suggests that across local labor markets, population shocks are largely reversed, which is in line with the locational fundamentals hypothesis.

Regression Results: For reasons discussed in Section 2, expellee-induced population growth in 1939-50 is unlikely to be completely orthogonal to underlying population growth potential in 1950-70. We therefore next test whether the unconditional correlations are still evident in a multivariate regression framework.

Table 2 reports our main regression results. The table reports conditional OLS (columns (1)-(3)) and IV estimates (columns (4)-(6)). For each set of estimates, we first present results that are based on the overall variation in expellee inflows (columns (1) and (4)), and then results that are based only on the variation of expellee inflows within local labor markets (columns (2) and (5)) and between local labor markets (columns (3) and (6)).

TABLE 2: Main Results

	OLS			IV		
	Overall	Within	Between	Overall	Within	Between
	(1)	(2)	(3)	(4)	(5)	(6)
Inflow Expellees 1950	-0.311**	0.131	-0.671***	-0.498***	-0.060	-0.830***
	(0.140)	(0.124)	(0.202)	(0.130)	(0.123)	(0.155)
Pop.density 1939	-0.021***	-0.012***	-0.012***	-0.021***	-0.011***	-0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Share agriculture 1939	-0.682***	-0.660***	-0.339***	-0.659***	-0.633***	-0.303***
	(0.098)	(0.096)	(0.105)	(0.095)	(0.091)	(0.107)
Turnover p.c. 1935	-0.003	-0.099***	0.053**	0.003	-0.104***	0.055**
	(0.021)	(0.019)	(0.024)	(0.020)	(0.020)	(0.024)
Share of damaged dwellings	0.208**	0.415***	-0.103	0.139	0.365***	-0.155**
	(0.088)	(0.103)	(0.087)	(0.086)	(0.100)	(0.077)
0/1 Inner-German border	-0.129***	-0.038	-0.095***	-0.108***	-0.036	-0.074**
	(0.037)	(0.033)	(0.032)	(0.037)	(0.033)	(0.034)
R-squared	0.314	0.260	0.441	0.307	0.255	0.434
Observations	511	511	157	511	511	157
F-Statistic, excl. instrument				995.4	716.4	563.5
First-stage coefficient				0.924***	0.941***	0.946***
				(0.029)	(0.035)	(0.040)

Notes: The dependent variable is the change in population between 1950-70 over the population in 1939. Regression models (1) and (4) use the overall variation in the data, whereas models (2) and (5) uses only the variation within local labor markets, and models (3) and (6) the variation between local labor markets (see Section 3 for details). The IV regressions in columns (4) to (6) use the expellee inflow rate in 1946 as an instrument for the expellee inflow rate in 1950. Robust standard errors are in brackets. Standard errors are clustered at the level of local labor markets in models (1), (2), (4), and (5). *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

In the first specification, we regress population growth between 1950 and 1970 on our key explanatory variable, the expellee inflow rate, and our set of covariates. As shown in column (1) of Table 2, the estimated coefficient on the expellee inflow rate is -0.311 with a standard error of 0.140. A one percentage point increase in a county's expellee inflow rate thus reduced subsequent population growth in 1950-70 by 0.311 percentage points. The result–based on the overall variation for West Germany at county level–suggests that there was some reversion to the pre-shock population distribution. Overall, therefore, counties subjected to a larger positive (negative) population shock in 1939-1950 tended to show lower (higher) average population growth in subsequent decades. However, the magnitude of reversion was limited, at least until 1970 and for West Germany as a whole.

In specifications (2) and (3), we decompose the total variation of the population shock into two components, a within local labor market component and a between local labor market component. Specification (2) considers the deviation of variables from the labor-market-wide mean. Exploiting only variation between counties within the same local labor market provides evidence on the persistence of population shocks that differentially hit counties located in the same labor market. As shown in column (2), the estimated coefficient on our population shock measure turns statistically insignificant in our within regression (and is now, with 0.131, even positive). Thus, within local labor markets, the population shock appears to have been persistent, showing no sign of reversion.

In specification (3), we aggregate our county-level data to the local labor market level and then re-run our full-fledged model at this higher level of regional aggregation. This way, we exploit only variation between local labor markets. The point estimate of -0.671 indicates that between local labor markets, the initial population shock was, to a large degree, reversed in 1950-70. For any percentage point increase in the expellee inflow rate in 1950, subsequent population growth was reduced by 0.671 percentage points. Comparing the results of specifications (1) and (3) also highlights the importance of the unit of observation: Moving from counties to local labor markets more than doubles the absolute magnitude of the coefficient on the expellee inflow rate.

We next estimate IV regressions to alleviate concerns that some expellees might have endogenously moved by 1950 after moving restrictions were phased out in 1949. The IV regressions isolate the variation in inflow rates that is due only to the initial placement of expellees. Their results are shown in columns (4)-(6) of Table 2.

The first-stage results suggest that we do not have a weak instrument problem. The IV results generally confirm our OLS results although the IV estimates are more negative than the OLS estimates. First, when using the overall-variation (column (1) vs. (4)), the estimated coefficient is now -0.498, considerably smaller than the OLS estimate of -0.311. Second, the within estimator now turns negative to -0.060 (column (5)). However, the estimated coefficient is not statistically significant at any conventional level. The expellee-induced population shock did not induce lower population growth in 1950-70, implying a persistent effect on the spatial distribution of population *within* local labor markets. Finally, the negative point estimate of the between specification also decreases slightly from -0.671 in specification (3) to -0.830 in specification (6). The estimate implies that a 1 percentage point increase in population growth between 1939 and 1950 reduces population growth between 1950 and 1970 by 0.830 percentage points. The population shock hence had very little effect on the spatial distribution of population *between* local labor markets 25 years after the war.

We also estimated the within regressions of Table 2 separately for the British, French and American zones of occupation (see Table B1 in the Online Appendix). We find little evidence of effect heterogeneity by zone of occupation. Treatment effects are all statistically insignificant, except in the IV regression for the American zone of occupation, in which we find an imprecisely estimated negative effect. Furthermore, we checked whether the use of a common denominator (1939 population) for the ratios used as dependent and independent variables may have introduced spurious correlation that would invalidate our estimates of the expellee effect. Re-estimating the main regressions from Table 2 for a dependent variable that normalizes the change in population between 1950-70 by the population in 1950 instead of 1939 produces results qualitatively identical to our main results reported in Table 2 (see Table C1 in the Online Appendix).

4.2 Robustness Checks

We conduct several tests to assess the robustness of our IV results. Table 3 provides the results of these robustness checks, reproducing our main results–from columns (5) and (6) of Table 2–in Panel A.

First, we use alternative measures of wartime destruction and urbanization, our two key control variables. In our baseline analysis, we use the share of damaged dwellings as a measure of war destruction, and pre-war population density as a measure of urbanization. As a robustness check, we instead use rubble in 1945 per inhabitant in 1939 and a categorical variable that ranges from 1 ”no destruction” to 4 ”heavy destruction” as alternative measures for war destruction. We also use the share of population in bigger cities and dummies for the size of the largest city in the local labor market as alternative measures for urbanization (see Section 3 for details on the alternative controls). In a final step, we use all destruction and urbanization measures jointly. Panel B. of Table 3 shows that our results remain robust to the use of these alternative measures of war destruction and urbanization.

Second, we add different measures of pre-war population growth to our set of controls (population growth in 1871-1910, 1910-1939, 1925-1939, and population growth in all of these periods). Pre-treatment trends in population dynamics, if correlated with expellee inflows in 1950, may confound our estimates of the effect of expellees on post-war population dynamics. As shown in Panel C. of Table 3, however, our findings also prove robust to the addition of such controls. In fact, estimated treatment coefficients in the between specification, rather than being attenuated, increase in absolute magnitude, getting closer to minus one.

Third, we add controls for pre-war economic structure (see Panel D. of Table 3), i.e., controls for the 1939 sectoral employment structure (industry, services, trade, domestic services) and the 1939 occupational employment structure (blue-collar, white-collar, civil servant, family coworker, self-employment). Differences in pre-war economic structure, if systematically related to the scale of the expellee inflow in 1950, may again confound our relationship of interest. Controlling for the sectoral and occupational employment structure in 1939, however, does not change our findings.

Finally, we carry out a number of additional miscellaneous checks. First, we estimate weighted regressions, using population in 1939 as weights (see top row in Panel E. of Table 3). Second, we re-estimate our baseline regression for an adjusted sample of 548 counties, in which we only merge those counties that formed one county at any time between 1939 and 1970 (see second row in Panel E. and Online Appendix F for further details). Finally, in the bottom row of Panel E. we estimate the within and between coefficients jointly (see the specification in footnote 14). Our results prove robust in all of these miscellaneous checks.

4.3 Net Migration Rate 1950-70

So far, we have considered the effect of the expellee inflow on post-war population growth. Our findings show that the migration-induced population shock had a persistent effect on the distribution of population within local labor markets, whereas the shock was largely reversed between labor markets. In this subsection, we document that these patterns reflect significant net migration flows occurring between but not within local labor markets. This observation will be important for the interpretation of our results in Section 5.

Specifically, we regress the net migration rate in 1950-70, defined as net migration in 1950-70 over population in 1939, on the expellee inflow rate in 1950 and our standard set of controls (see Table 4). As before, we run both OLS and IV regressions, exploiting either the overall, within, or between variation in

TABLE 3: Robustness Checks - IV Results on Expellee Inflow Effect

	Within (1)	Between (2)
A. Baseline regression	-0.060	-0.830***
	(0.123)	(0.155)
B. *Alternative control variables for destruction and urbanization*		
... using rubble per capita	-0.138	-0.781***
	(0.128)	(0.143)
... using loss in housing space (categorial)	-0.123	-0.791***
	(0.129)	(0.147)
... using population share in cities with at least of 10,000 inhabitants in 1939	-0.165	-0.789***
	(0.128)	(0.164)
... using dummies for size of largest city in the local labor market	-0.095	-0.847***
	(0.121)	(0.155)
... using all destruction and urbanization measures jointly	-0.105	-0.777***
	(0.128)	(0.168)
C. *Pre-war population trends*		
... adding population growth 1871-1910	-0.071	-0.834***
	(0.126)	(0.152)
... adding population growth 1910-1939	-0.002	-0.831***
	(0.133)	(0.154)
... adding population growth 1925-1939	0.006	-0.953***
	(0.155)	(0.159)
... adding population growth 1871-1910, 1910-1939, and 1925-1939	-0.023	-0.962***
	(0.154)	(0.154)
D. *Pre-war economic structure*		
... adding controls for sectoral employment structure 1939	0.073	-0.792***
	(0.150)	(0.188)
... adding controls for occupational employment structure 1939	-0.149	-0.759***
	(0.131)	(0.135)
... adding controls for sectoral and occupational employment structure	-0.060	-0.715***
	(0.156)	(0.134)
E. *Miscellaneous checks*		
... weighted with 1939 population	-0.067	-0.798***
	(0.114)	(0.148)
... without additional border adjustments	0.047	-0.920***
	(0.129)	(0.109)
... jointly estimated β_2 and β_3	0.050	-0.777***
	(0.139)	(0.127)

Notes: The table reports IV estimates of the effect of the expellee inflow rate in 1950 on population growth in 1950-1970. Each cell reports estimates from a separate regression, except for the coefficients in the last row of Panel E. The dependent variable is the change in population between 1950-70 over the population in 1939. Regression model (1) uses the variation within local labor markets, and model (2) uses the variation between local labor markets (see Section 3 for details). Each regression in Panel A., C., D. and E. includes our standard set of control variables, i.e., population density in 1939, the employment share in agriculture in 1939, turnover per capita in 1935, the share of damaged dwellings, and a dummy for counties within 75 km of the inner-German border. Regressions in Panel B. include our standard set of control variables but replace the standard covariates for wartime destruction and urbanization by alternative covariates. Regressions in Panel C. add different measures of pre-war population growth to the set of control variables. Regressions in Panel D. add controls for the 1939 sectoral employment structure (industry, services, trade, domestic services) and occupational employment structure (blue-collar, white-collar, civil servant, family co-worker, self-employment) to the set of control variables. The first regression in Panel E. estimates weighted regressions, using the 1939 population as weights. The second regression in Panel E. is our baseline regression applied to an adjusted sample of 548 counties, in which we only merge those counties that formed one county at any time between 1939 and 1970 (see Online Appendix F). The third regression in Panel E. estimates the within and between coefficients jointly, see footnote 14. Robust standard errors are in brackets. Standard errors are clustered at the level of local labor markets in column (2). *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

TABLE 4: Expellee Inflows and Net Migration Rates 1950-70

	OLS			IV		
	Overall	Within	Between	Overall	Within	Between
	(1)	(2)	(3)	(4)	(5)	(6)
Inflow Expellees 1950	-0.340***	0.012	-0.663***	-0.513***	-0.166*	-0.788***
	(0.128)	(0.101)	(0.159)	(0.119)	(0.095)	(0.125)
R-squared	0.424	0.425	0.574	0.418	0.420	0.568
Observations	511	511	157	511	511	157
F-Statistic, excl. instrument				995.4	716.4	563.5
First-stage coefficient				0.924***	0.941***	0.946***
				(0.029)	(0.035)	(0.040)

Notes: The dependent variable is net migration between 1950 and 1970 over the population in 1939. Each regression includes our standard set of control variables, i.e., population density in 1939, the employment share in agriculture in 1939, turnover per capita in 1935, the share of damaged dwellings, and a dummy for counties within 75 km of the inner-German border. Regression models (1) and (4) use the overall variation in the data, whereas models (2) and (5) use only the variation within local labor markets, and models (3) and (6) the variation between local labor markets (see Section 3 for details). The IV regressions in columns (4) to (6) use the expellee inflow rate in 1946 as an instrument for the expellee inflow rate in 1950. Robust standard errors are in brackets. Standard errors are clustered at the level of local labor markets in models (1), (2), (4), and (5). *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

expellee inflow rates. The estimated coefficients of the expellee inflow rate in 1950 have the same sign and are close in magnitude to the corresponding coefficients in our baseline regressions reported in Table 2. This suggests that post-displacement migration flows do indeed explain a very large share of the overall effect that expellee inflows had on post-war population growth in 1950-70, both overall and between local labor markets.[17] The estimated coefficient of the expellee inflow rate in 1950 in the IV within regression (column (5)), while marginally significant at the 10% level, is but a fifth in magnitude of that of the corresponding coefficient estimate in the IV between regression (column (6)). Post-displacement migration flows hence depend much more heavily on variation in expellee inflow rates between than within local labor markets.

These results have implications also for the literature that studies the link between immigrant inflows and population outflows. In particular, we showed that expellee inflows and net population flows are much more strongly correlated between than within local labor markets. Previous work suggests that expellees were particularly mobile and thus responsible for a disproportionate share of population movements (Braun and Kvasnicka, 2014; Braun and Weber, 2016). Consistent with these earlier findings, Figure E1 in the Online Appendix shows that the distribution of expellee population shares at county level was much less dispersed in 1961 than in 1950 (the standard deviation decreased from 0.093 in 1950 to 0.063 in 1961). Expellees were more equally distributed in 1961 than in 1950, as they moved in disproportionate numbers from regions with high expellee inflows to regions with low expellee inflows. One potential explanation for this empirical fact is that newly arrived expellees were less bound to specific regions than natives–and hence reacted stronger to regional differences in economic opportunities, in line with the hypothesis that 'immigrants grease the wheels of the labor market' (Borjas, 2001).

[17] The net migration rate is one component of total population growth. The latter is made up of the sum of net migration and net natural changes of population. Since we normalize both population growth and net migration by population in 1939, coefficients in Tables 2 and 4 are directly comparable.

4.4 Alternative Units of Observation

We conclude by highlighting once more–but in an alternative and more direct way of exposition that also considers an additional and larger regional unit than the local labor market–the importance of the unit of observation for the estimated effect of the expellee inflow on subsequent population growth. We have already shown that moving from counties to local labor markets as the unit of observation considerably increases the absolute magnitude of the coefficient on the expellee inflow rate in both OLS and IV regressions. Panels A. and B. of Table 5 reproduce these earlier results from Table 2 (columns (1), (3), (4), and (6)). Panel C. adds a third level of regional aggregation, and estimates our standard regression at the level of *Raumordnungsregionen*, of which there are 36 in post-war West Germany. *Raumordnungsregionen* are also based on a functional definition, but cover a larger set of counties than local labor market regions.

TABLE 5: Alternative Units of Observation

	OLS (1)	IV (2)
A. Counties (N=511)	-0.311**	-0.498***
	(0.140)	(0.130)
B. Local Labor Markets (N=157)	-0.671***	-0.830***
	(0.202)	(0.155)
C. Raumordnungsregionen (N=36)	-0.832***	-0.960***
	(0.188)	(0.187)

Notes: The table reports OLS and IV estimates of the effect of the expellee inflow rate in 1950 on population growth in 1950-1970. Each cell reports estimates from a separate regression. The dependent variable is the change in population between 1950-70 over the population in 1939. Control variables are population density in 1939, the employment share in agriculture in 1939, turnover per capita in 1935, the share of damaged dwellings, and a dummy for counties within 75 km of the inner-German border. Panel A. considers the 511 counties in West Germany, Panel B. the 157 local labor markets, and Panel C. the 36 *Raumordnungsregionen* in West Germany. Robust standard errors are in brackets. Standard errors in Panel A. are clustered at the level of local labor markets. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 5 shows that at each level of aggregation, the expellee inflow rate exerts a negative impact on population growth in 1950-70. Most importantly, however, the absolute magnitude of this effect increases considerably with the level of aggregation. It is lowest for counties (Panel A.), i.e., the smallest unit considered, and highest for *Raumordnungsregionen* (Panel C.), the largest aggregation level. Local labor markets (Panel B.) fall in between these two, both in terms of aggregation level and in the absolute size of the estimated effect. The higher the level of aggregation, therefore, the less persistent proves the initial population shock. In fact, the IV coefficient estimate of -0.960 for *Raumordnungsregionen* suggests that at this largest aggregation level considered, the initial population shock was almost completely reversed by 1970.

5 Interpretation

We now explore potential explanations for the high persistence of the population shock within but not across local labor markets. We interpret our findings through the lenses of the monocentric city model in the spirit of Alonso (1964), Mills (1967) and Muth (1969).[18] The model's distinction between the distribution of population *between* and *within* urban areas makes it a natural starting point for our purpose. We can think of labor markets as functional urban areas, which consist of a city and the surrounding periphery (Dijkstra et al., 2019). The periphery is integrated into the city's labor market through commuting. We first consider the distribution of population between and then within labor markets.

Between Labor Markets: Consider a single labor market within a system of many labor markets. Individuals in the labor market receive indirect utility $V(N)$ where N is the population of the labor market. In the standard monocentric model, $V(N)$ is strictly decreasing in N, as higher population drives up house prices without affecting the exogenously given wage. Costless migration between labor markets ensures that utility is the same in all labor markets and equal to the exogenous reservation utility $\overline{V}$. This spatial equilibrium condition is illustrated in Panel (a) of Figure 5. The equilibrium A with (N_1, $\overline{V}$) occurs at the intersection of the downward sloping indirect utility curve $V(N)$ with line $\overline{V}$. This first view predicts that temporary population shocks have no permanent effects. Suppose, for instance, that population increases from N_1 to N_2 (due to exogenous immigration). Indirect utility falls to V_2, inducing individuals to emigrate to other labor markets. Equilibrium is then restored in A.[19]

Even in this view, however, population shocks may permanently affect population patterns if they alter second nature geography, a point recently highlighted by Maystadt and Duranton (2018).[20] Suppose, for instance, that policy makers respond to immigration by investing in commuting infrastructure, thereby shifting the indirect utility function to $V(N)'$. The new unique equilibrium is now in B with (N_3, $\overline{V}$). As drawn, we would still observe emigration (of magnitude $N_2 - N_3$) but population does not revert back to its initial level.[21] This interpretation is consistent with our findings, as we observe strong but incomplete reversal of the initial population shock between labor markets.

The traditional view sketched so far highlights the costs of bigger labor markets. An alternative view stresses the productive benefits of larger labor markets in the form of agglomeration economies. For instance, interactions between workers may be more productive in thicker labor markets, so that wages in-

[18]We present only a stylized description of the underlying model. Interested readers might consult Brueckner (1987) or Fujita (1989) for a detailed description of the monocentric city model and Duranton and Puga (2014) for a recent review of key theories of urban growth. We focus on the open city case of the monocentric model where population is endogenous. The closed case treats population as exogenous and allows utility to adjust.

[19]For the sake of simplicity, we discuss the effect of immigration from the perspective of a single labor market. We thus abstract from the effects of system wide shocks that affect all labor markets in an economy. Our focus on a single labor market is clearly an oversimplification in our context. However, it is in line with the typical empirical specification in the literature, which studies the effect of shocks on the size or growth of individual spatial units (Brakman et al., 2004). Our specification in (1) is no exception in this regard.

[20]The paper shows that the temporary presence of refugees had permanent positive effects on hosting economies in Tanzania. The authors present evidence that this 'Big-Push' effect of refugees was due to subsequent investments in transport infrastructure rather than a switch to a new equilibrium in a setting with multiple equilibria.

[21]The monocentric model with endogeneous population predicts that lower commuting costs, higher wages, and lower agricultural rents increase city-wide population (Brueckner, 1987).

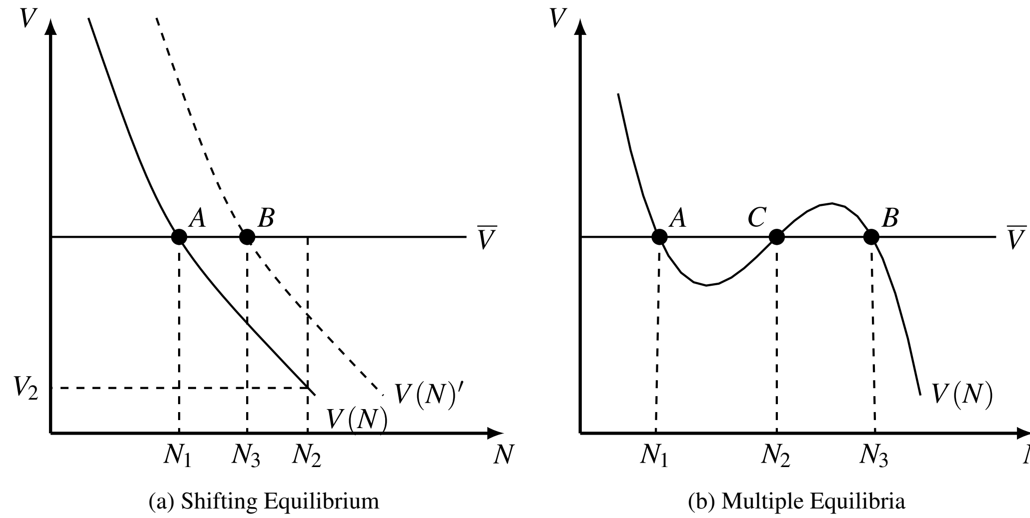


FIG. 5: Local Labor Market Population following Immigration

crease in population. Population increases then have two opposing effects on individuals' utility, a negative one through higher congestion costs and a positive one through higher wages. If the latter effect dominates the former, indirect utility will increase with labor market size.

Panel (b) of Figure 5 illustrates such a case. As drawn, agglomeration economies dominate congestion costs for intermediate population levels (as in, e.g., Bleakley and Lin, 2012).[22] $V(N)$ now intersects $\overline{V}$ three times. A and B are stable equilibria, which are restored following small perturbations. The third equilibrium in C is unstable, as the labor market would move to either A or B following small perturbations away from C. Under agglomeration economies, population shocks can have permanent effects by shifting the labor market from one equilibrium to another. Suppose, for instance, that labor market equilibrium is in A with $(N_1, \overline{V})$. If immigration boosts population to beyond N_2, the labor market will permanently shift to B with $(N_3, \overline{V})$. In addition, we will observe out-migration if immigration increases population to beyond N_3. Importantly, these results hold without changes in second nature geography. Our result of incomplete population reversal at the level of local labor markets could thus also be interpreted as a shift between multiple equilibria.

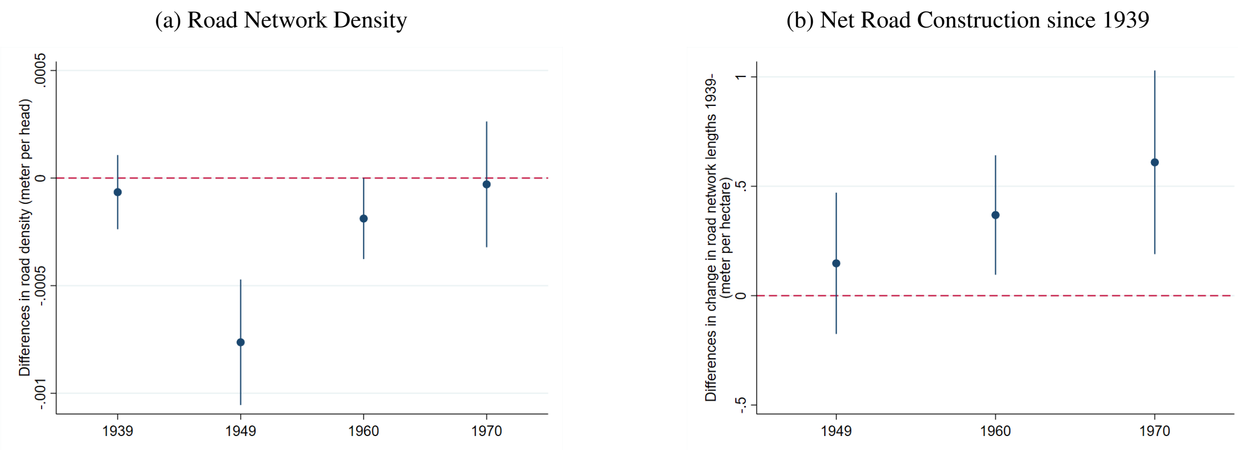
Do our results point to a shift in the unique equilibrium induced by infrastructure investments or to the existence of multiple equilibria? While a conclusive answer is beyond the scope of the paper, the development of the local road network in 1939-70 sheds some light on this question. Data are available for municipalities with at least 10,000 inhabitants (from various volumes of the *Statistical Yearbooks of German Municipalities*), though unfortunately not at county level. We distinguish between municipalities with 1950 expellee inflow rates above and below the median. Panel (a) of Figure 6 plots the difference in roads per capita between the two groups, along with the corresponding confidence intervals.[23] The figure illustrates

[22] Bleakley and Lin (2012) discuss the plausibility of this shape of the indirect utility function in their footnote 27.

[23] We restrict our sample to the 152 municipalities for which data are available for all time periods. The underlying regression controls for log population in 1939 and land area. The results are also robust to adding indicators for war destruction, which are, however, not available for all municipalities in our sample. The results are also robust to dropping municipalities that absorbed other municipalities or settlements over time.

that high- and low-inflow municipalities did not differ in the road network density (in meter per head) before the war. The effect of the expellee inflow is clearly visible in 1949, when road density per head was much lower in high-inflow municipalities. By 1970, however, the difference has disappeared.

FIG. 6: Differences in Road Networks between Municipalities with High and Low Expellee Inflows



Notes: The figures depicts differences between municipalities with expellee inflow rates above and below the median in road density in meter per head (Panel (a)) and in the change in roads per hectare since 1939 (Panel (b)). Differences are estimated in regressions of the dependent variable on a dummy indicating whether a municipality's expellee inflow rate in 1950 is above or below the median inflow rate. Control variables are log population in 1939 and land area. Each point estimate is marked by a dot and stems from a separate regression. The vertical bands indicate the 95 percent confidence interval of each estimate.

Panel (b) of Figure 6 shows that part of the adjustment process in 1949-70 was driven by more road construction in high-inflow municipalities (rather than population outflows). Between 1939 and 1970, the length of the road network increased by 6.1 meters per hectare more in high-inflow than in low-inflow municipalities (or by 46.9% relative to the control mean of 13.0). This gap in road construction only emerges after the expellee inflow. The results in Figure 6 are thus consistent with the idea that infrastructure investment acted as an equilibrium shifter.

Overall, our discussion suggests that the weak persistence of the population shock between labor markets is best understood as the result of migration-induced investments into road infrastructure. These investments shifted the equilibrium size of labor markets, but were insufficient to prevent out-migration from high- to low-inflow labor markets.

Within Labor Markets: Can we square this explanation for weak persistence between labor markets with our finding of strong persistence within labor markets? We argue that the persistent effect within labor markets reflects sub-urbanization, induced by road infrastructure investment. Since expellees arrived pre-dominantly in the labor market periphery (as we document below), initial inflows were not correlated with later population growth within labor markets. This was because the population shares in the labor market core and periphery in 1950 were already (largely) consistent with the new equilibrium, while the labor-market wide population level was not. We first illustrate the argument theoretically, and then provide suggestive empirical evidence.

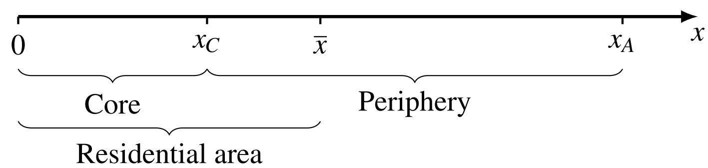


FIG. 7: Labor Market Core, Periphery and Residential Area

Our theoretical discussion closely follows Duranton and Puga (2015), to which we refer the interested reader for details. Consider a linear monocentric labor market. As before, migration between labor markets equalizes utility to a common and exogenous level. All residents commute to a job at a single point $x = 0$, the central business district (CBD). Commuting costs, given by τx, increase linearly with distance to the CBD. All residents earn the same wage from employment in the CBD. This leaves $w - \tau x$ for expenditure on housing and a numeraire good. While the price of the numeraire good is the same everywhere, the rental price of housing varies with distance to the CBD. Housing is produced by a perfectly competitive construction industry, using land and capital under constant returns to scale. All individuals are identical and freely mobile. Therefore, they must derive a common utility level at the residential equilibrium.

The model predicts that in equilibrium, the price of units of housing increases as we move closer to the CBD. Centrally located residents economize on housing and inhabit smaller dwellings. The model thus highlights the fundamental trade-off between accessibility and space in residential choice. Higher housing prices close to the CBD are reflected in higher land prices, which in turn cause developers to build taller buildings. Consequently, population density increases as we move closer to the CBD due to a combination of taller buildings and smaller individual dwellings. Land is built upon if the rent in residential use, $R(x)$, is at least as high as the rent $\underline{R}$ in the next best alternative use, say agriculture. The edge of the residential area is thus located at an endogenously determined distance $x = \bar{x}$ from the CBD, such that $R(\bar{x}) = \underline{R}$.

Within the model, a reduction in local commuting costs τ, e.g. from an expansion of the road network, will increase total population, consistent with our previous discussion of labor market wide population. The population increase, which comes in response to the utility gain from lower commuting costs, drives up house prices everywhere. More expensive housing then offsets the utility gain and restores utility equalization between labor markets. The additional population is accommodated through two channels, rising densities and an expansion of the residential area. The model predicts that the second channel is the more important one, so that local infrastructure improvements increase the population share of the periphery.

To see this, define the labor market core as the segment between $x = 0$ and an exogenous point x_C, and the periphery as the segment between x_C and the exogenous administrative border of the labor market x_A (where $x_C < \bar{x} < x_A$, see Figure 7). The extent of the residential area has to be sufficient to house the labor market population, i.e.,

$$N = \int_0^{\bar{x}} n(x)dx, \tag{4}$$

where $n(x)$ is population density. Following Duranton and Puga (2015), density can be expressed as $n(x) = -\frac{1}{\tau}dR(x)dx$. Let $N_P = \int_{x_C}^{\bar{x}} n(x)dx$ denote the (endogenous) population in the periphery. Using the expression

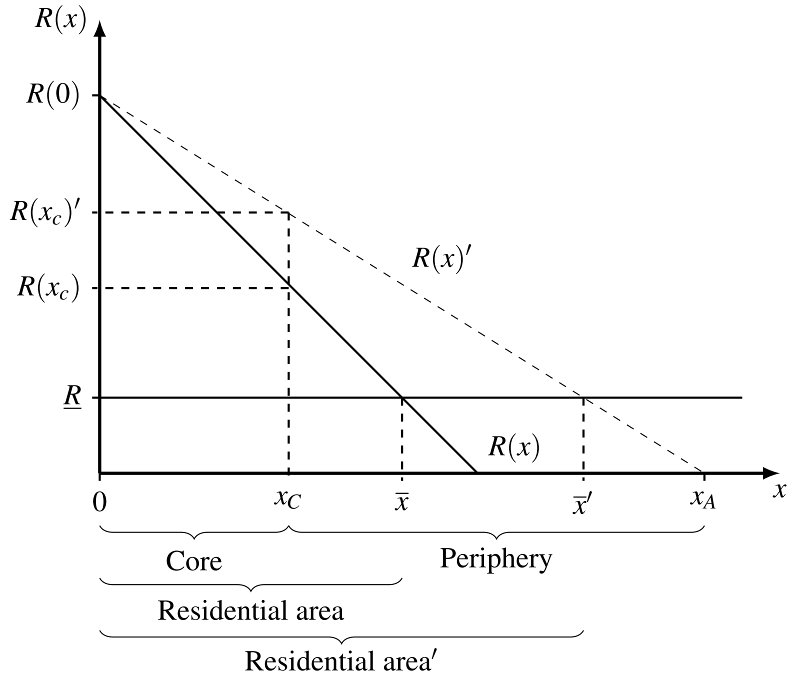


FIG. 8: The Effect of Lower Commuting Cost on Land Rents and the Edge of the Residential Area

for $n(x)$, one can solve for N and N_P:

$$N = \frac{R(0) - \underline{R}}{\tau}, \;\; N_P = \frac{R(x_c) - \underline{R}}{\tau}, \tag{5}$$

where we have used that $R(\bar{x}) = \underline{R}$. The share of the total population located in the periphery is thus

$$\frac{N_P}{N} = \frac{R(x_c) - \underline{R}}{R(0) - \underline{R}}. \tag{6}$$

Figure 8, adapted from Duranton and Puga (2014), illustrates the effect of lower commuting costs on population shares in the core and periphery. It plots land rents $R(x)$ as a function of distance to the CBD before (solid line) and after (dashed line) the decline in τ. The intersection of $R(x)$ with $\underline{R}$ determines the edge of the residential area. The fall in τ causes land rents to increase everywhere except at $x = 0$ where residents do not benefit directly from lower commuting costs (and immigration keeps utility unchanged). The shift in land rents pushes out the edge of the residential area from $\bar{x}$ to $\bar{x}'$ but leaves the land rent at the edge unchanged at $\underline{R}$. Equation (6) then implies that the share of population in the periphery increases after a fall in τ. Better commuting infrastructure increases the share of land built on in the periphery, thereby boosting sub-urbanization.

In summary, immigrant inflows, by inducing infrastructure improvements, can cause a permanent increase in the population share of the periphery. If immigrants arrive mainly in the periphery, as is the case in our setting, the initial inflows might not correlate with subsequent population growth within labor markets. This is because the migration-induced change in the population shares in core and periphery might already

TABLE 6: Difference in Expellee Inflow Rates and Sub-urbanization

	1939-50		1939-70	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Difference in expellee inflow rate 1950	0.241***	0.235***	0.171***	0.153***
(Periphery - Core)	(0.022)	(0.025)	(0.029)	(0.031)
Pop.density 1939	-0.001**	-0.002***	-0.002**	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Share Agriculture 1939	-0.040	-0.042	-0.100***	-0.105***
	(0.031)	(0.030)	(0.034)	(0.033)
Turnover p.c. 1935	0.004	0.004	0.010*	0.010*
	(0.005)	(0.005)	(0.006)	(0.006)
Share of damaged dwellings	0.079***	0.078***	0.099***	0.097***
	(0.024)	(0.023)	(0.028)	(0.028)
0/1 Inner-German border	-0.004	-0.004	0.000	0.002
	(0.006)	(0.006)	(0.008)	(0.008)
R-squared	0.684	0.684	0.635	0.634
Observations	104	104	104	104
F-Statistic, excl. instrument		323.3		323.3
First-stage coefficient		0.939***		0.939***
SE		(0.052)		(0.052)

Notes: The dependent variable is the change in the suburbanization rate in 1939-50 (columns (1) and (2)) and 1939-70 (columns (3) and (4)). Suburbanization is defined as the population of a labor market residing in peripheral counties. We exclude the 53 labor markets, for which all counties belong to the core or no core can be identified. The IV regressions in columns (2) and (4) use the difference in the expellee inflow rate in 1946 as an instrument for the difference in the expellee inflow rate in 1950. Robust standard errors are in brackets. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

be consistent with the post-migration equilibrium shares. This argument does not preclude emigration from high- to low-inflow labor markets. It just requires these emigration flows to not originate disproportionally from the periphery.

We conclude our discussion by providing three pieces of suggestive evidence that are consistent with our interpretation. First, within a labor market, expellees arrived disproportionally in counties that belonged to the labor market periphery rather than the labor market core.[24] The average difference between the inflow rate in the periphery and core is 9.2 percentage points in our data (relative to a labor-market-wide inflow rate of 25.3 percent).

Second, the differential expellee inflow rates had a persistent positive effect on a labor market's sub-urbanization rate, as measured by the population share in the periphery. Table 6 reports the results from regressing, at the level of labor markets, the change in the suburbanization rate in 1939-1950 (column (1))

[24] We classify counties in our data as belonging to the labor market core if they encompass the labor market center (*Arbeitsmarktmittelpunkt*), as listed in IfW (1974). All other counties are classified as periphery. The classification is likely to underestimate the true difference between core and periphery, as counties in the core often encompass both the labor market center and parts of the periphery. We drop the 53 (out of 157) labor markets for which all counties belong to the labor market core or no core could be identified.

TABLE 7: Within Labor Markets Regression Results for Core-Periphery Classification

	County		Core-Periphery	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Inflow Expellees 1950	0.131	-0.060	0.034	-0.159
	(0.124)	(0.123)	(0.207)	(0.211)
Pop.density 1939	-0.012***	-0.011***	-0.007***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
Share agriculture 1939	-0.660***	-0.633***	-0.607***	-0.582***
	(0.096)	(0.091)	(0.149)	(0.137)
Turnover p.c. 1935	-0.099***	-0.104***	-0.062***	-0.065***
	(0.019)	(0.020)	(0.019)	(0.020)
Share of damaged dwellings	0.415***	0.365***	0.098	0.065
	(0.103)	(0.100)	(0.117)	(0.128)
0/1 Inner-German border	-0.038	-0.036	0.017	0.024
	(0.033)	(0.033)	(0.043)	(0.040)
R-squared	0.260	0.255	0.325	0.318
Observations	511	511	261	261
F-Statistic, excl. instrument		716.4		312.6
First-stage coefficient		0.941***		0.896***
		(0.035)		(0.051)

Notes: The dependent variable is the change in population between 1950-70 over the population in 1939. All regression models use only the variation within local labor markets (see Section 3 for details). Models (1) and (2) are estimated on the 511 counties. Models (3) and (4) are estimated on aggregated data, which aggregates all counties in the core of a labor market and all counties in the periphery. The IV regressions in columns (2) and (4) use the expellee inflow rate in 1946 as an instrument for the expellee inflow rate in 1950. Robust standard errors clustered at the level of local labor markets are in brackets. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

and 1939-70 (column (3)) on the difference in the expellee inflow rate between periphery and core, and our usual control variables. The IV regressions in columns (2) and (4) instrument the differential expellee inflow rate in 1950 with that in 1946. The coefficient estimate of 0.235 in the IV regression in column (2) suggests that a one standard deviation increase in the differential expellee inflow rate (s.d. of 0.135) increased the change in the suburbanization rate in 1939-50 by 0.68 standard deviations (s.d. of 0.047). While the coefficient estimate decreases somewhat for suburbanization in 1939-70, it remains positive, statistically significant and economically meaningful (at roughly two-thirds of the size for 1939-50).

Third, we continue to find population shocks to be persistent within labor markets also when distinguishing only between core and periphery. Specifically, we re-run our main regression using the variation in expellee inflows within labor markets, but now aggregate counties in the core and periphery. We thus have at most two observations per labor market, one for the core and one for the periphery. Table 7 shows the resulting OLS and IV regression results in columns (3) and (4), while reproducing our original regression results in columns (1) and (2) (from Table 2, columns (2) and (5)). Results are very similar to our baseline estimates. In particular, expellee-induced population shocks, which differentially affected core and periphery, had no statistically significant effect on within labor market population growth in 1950-70.

6 Conclusion

This paper has explored the importance of local labor markets for the persistence of a major population shock, the inflow of eight million expellees to different parts of West Germany after World War II. Our results show that the estimated regional persistence of this shock depends crucially on the type of regional unit considered and the type of variation in expellee inflows exploited. The population shock proved persistent within local labor markets, but was largely reversed between labor markets. We argue that the persistent effect within labor markets is best understood as a relative decline of the labor market core, caused by migration-induced investments into transport infrastructure. These investments also shifted the equilibrium size of labor markets but were not sufficient to prevent emigration from labor markets with high initial expellee inflows.

Our findings suggest that the choice of the regional unit should be carefully motivated when drawing conclusions from the persistence of population shocks about the determinants of the spatial distribution of economic activity. This is because these determinants are likely to differ between and within labor markets. This simple insight can also help to better understand the disparate findings in the literature on the persistence of population shocks. Early seminal work in the literature typically focused on cities as spatial units to discriminate between explanations for the distribution of economic activity (Davis and Weinstein, 2002; Brakman et al., 2004). Later work, for instance by Schumann (2014), often focused on municipalities, of which many are located in the same labor market. Our findings suggest that the results from these two bodies of literature are difficult to compare because the determinants of spatial equilibrium tend to differ between and within labor markets.

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Online Appendix

A Balancing Test on 1939 Covariates

We carried out a balancing test on 1939 variables for counties with expellee inflow rates above and below the median (see Table A1). The table shows, as expected, pronounced unconditional differences between high- and low-inflow regions, which we described already in Section 2 when discussing the historical background to our setting. Among other differences, high-inflow regions are less urban, have more employment in agriculture, and less employment in industry. However, the table also shows that these differences decline markedly, and most of the time disappear altogether, when we condition on war destruction. Apart from geographical factors, differences between high- and low-inflow regions are hence driven primarily by war destruction and the associated availability of housing. Conditional on such destruction, remaining differences are generally minor at best.

TABLE A1: Balancing Test on 1939 Covariates–High and Low Inflow Counties

	High inflow	Low inflow	Unconditional difference	Conditional difference
	(1)	(2)	(3)	(4)
Pop. density 1939	1.747	6.952	-5.205***	0.264
	(3.183)	(8.924)	[0.765]	[0.493]
Pop. share in cities $\geq$ 10,000 inhabitants 1939	0.147	0.450	-0.303***	-0.029
	(0.301)	(0.434)	[0.039]	[0.037]
Turnover p.c. 1935	1.183	1.598	-0.415***	0.066
	(0.576)	(1.035)	[0.080]	[0.076]
Share of damaged dwellings	0.068	0.305	-0.236***	-
	(0.069)	(0.247)	[0.020]	
0/1 Inner-German border	0.424	0.109	0.314***	0.303***
	(0.495)	(0.313)	[0.054]	[0.059]
Sectoral employment structure 1939 (shares):				
Agriculture	0.479	0.282	0.197***	0.056**
	(0.202)	(0.225)	[0.023]	[0.024]
Industry	0.303	0.423	-0.120***	-0.056***
	(0.122)	(0.149)	[0.019]	[0.018]
Private services	0.079	0.102	-0.024***	0.000
	(0.055)	(0.073)	[0.005]	[0.007]
Trade and transport	0.109	0.153	-0.043***	0.000
	(0.067)	(0.076)	[0.006]	[0.007]
Domestic services	0.030	0.040	-0.010***	-0.001
	(0.016)	(0.018)	[0.002]	[0.002]
Occupational employment structure 1939 (shares):				
Blue collar worker	0.395	0.473	-0.078***	-0.016
	(0.108)	(0.126)	[0.015]	[0.015]
White collar worker	0.072	0.120	-0.048***	-0.005
	(0.048)	(0.070)	[0.005]	[0.006]
Helping family member	0.303	0.200	0.103***	0.015
	(0.124)	(0.143)	[0.014]	[0.015]
Civil servant	0.041	0.054	-0.013***	0.001
	(0.031)	(0.037)	[0.003]	[0.003]
Self employed	0.189	0.153	0.036***	0.005
	(0.044)	(0.050)	[0.006]	[0.006]

Notes: The table compares the characteristics of regions with expellee shares above the median (high inflow regions) and regions below the median (low inflow regions). Columns (1) and (2) report the mean of each characteristic. Columns (3) and (4) report unconditional and conditional differences between high and low inflow regions, respectively. The conditional difference in column (4) is the coefficient on a dummy for high inflow regions in regressions that control for the share of damaged dwellings. Standard deviations are in parentheses, robust standard errors clustered at the level of local labor markets are in squared brackets. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

B Within Regression Results by Zone of Occupation

TABLE B1: Within Regression Results by Zone of Occupation

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflow Expellees 1950	-0.036	-0.107	0.260	-0.090	0.043	-0.496*
	(0.175)	(0.286)	(0.276)	(0.164)	(0.352)	(0.261)
R-squared	0.153	0.341	0.350	0.152	0.340	0.312
Observations	165	81	265	165	81	265
Occupation zone	British	French	American	British	French	American
F-Statistic				658.3	108.1	346.7
First-stage coefficient				0.968	0.852	0.909
				0.0377	0.0819	0.0488

Notes: The table shows results of re-estimating the OLS and IV within regressions in Table 2 separately for the British, French and American zones of occupation. The dependent variable is the change in population between 1950-70 over the population in 1939. Each regression includes our standard set of control variables, i.e., population density in 1939, the employment share in agriculture in 1939, turnover per capita in 1935, the share of damaged dwellings, and a dummy for counties within 75 km of the inner-German border. Robust standard errors clustered at the level of local labor markets are in brackets. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

C Regression Results for Alternative Dependent Variable

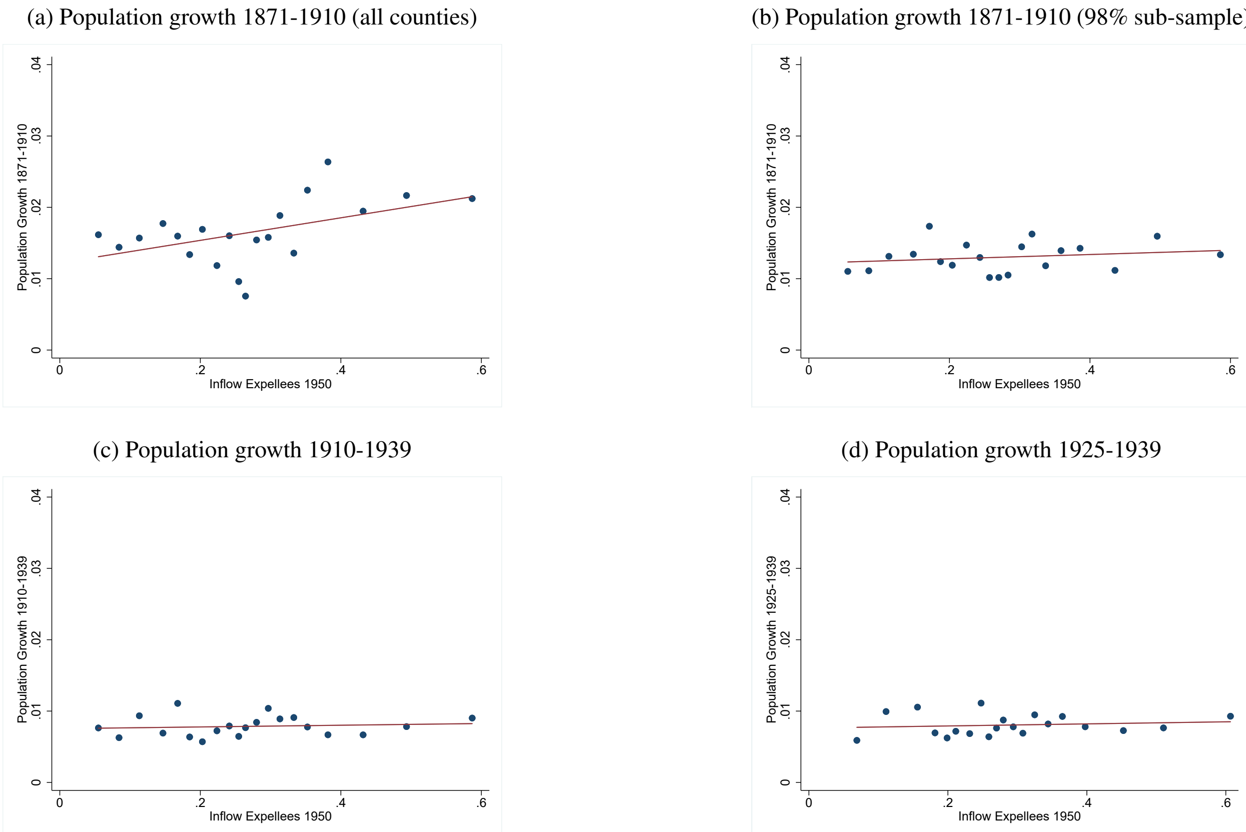
TABLE C1: Main Regression Results for Dependent Variable: (Pop. 1970 - Pop.1950)/Pop.1950

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflow Expellees 1950	-0.334***	0.025	-0.560***	-0.447***	-0.072	-0.669***
	(0.088)	(0.081)	(0.120)	(0.084)	(0.086)	(0.095)
Pop.density 1939/100	-0.016***	-0.010***	-0.010***	-0.016***	-0.010***	-0.010***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Share Agriculture 1939	-0.464***	-0.430***	-0.247***	-0.450***	-0.416***	-0.223***
	(0.068)	(0.065)	(0.078)	(0.065)	(0.062)	(0.079)
Turnover p.c. 1935	0.018	-0.057***	0.055***	0.021	-0.060***	0.056***
	(0.014)	(0.013)	(0.019)	(0.014)	(0.014)	(0.019)
Loss in housing space (cont.)	0.247***	0.504***	-0.011	0.205***	0.479***	-0.047
	(0.067)	(0.081)	(0.066)	(0.067)	(0.078)	(0.062)
0/1 Inner-German border	-0.089***	-0.029	-0.079***	-0.076***	-0.028	-0.065***
	(0.024)	(0.023)	(0.022)	(0.024)	(0.022)	(0.022)
R-squared	0.409	0.335	0.573	0.405	0.332	0.567
Observations	511	511	157	511	511	157
F-Statistic, excl. instruments				995.4	716.4	563.5
First-stage coefficient				0.924***	0.941***	0.946***
				(0.029)	(0.035)	(0.040)

Notes: The table shows results of re-estimating the regressions in Table 2 for a slightly changed dependent variable, the change in population between 1950-70 over the population in 1950. Otherwise, specifications are identical to those in Table 2. Regression models (1) and (4) use the overall variation in the data, whereas models (2) and (5) uses only the variation within local labor markets, and models (3) and (6) the variation between local labor markets (see Section 3 for details). Robust standard errors are in brackets. Standard errors are clustered at the level of local labor markets in models (1), (2), (4), and (5). *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

D Binned Scatter Plots – Expellee Inflows and Pre-war Population Growth

FIG. D1 : Binned Scatter Plots (Conditional)



(a) Population growth 1871-1910 (all counties)

(b) Population growth 1871-1910 (98% sub-sample)

(c) Population growth 1910-1939

(d) Population growth 1925-1939

Notes: The figures in Panel (a), (b), (c) and (d) depict binned scatter plots of residualized population growth in 1871-1910 (Panel (a) and (b)), 1910-1939 (Panel (c)), and 1925-1939 (Panel (d)) and residualized expellee inflow rates in 1950, grouping expellee inflow rates into 20 equal-sized bins. The 98% sub-sample considered in Panel (b) excludes the top 11 (2% of) counties with the fastest population growth in the period 1871-1910. Covariates include our standard set of control variables, i.e., population density in 1939, the employment share in agriculture in 1939, turnover per capita in 1935, the share of damaged dwellings, and a dummy for counties within 75 km of the inner-German border. See Table 1 in the main text for the corresponding regression results.

E Kernel Density Estimates of Expellee Share in 1950 and 1961

FIG. E1 : Kernel Density Estimates

Notes: The figure shows Kernel density estimates of the expellee population share at county level on 17 September 1950 (solid line) and 6 June 1961 (dashed line).

F Merging of Counties

The administrative borders of some West German counties changed between 1939 and 1970. In order to make county borders comparable over time, we follow the procedure outlined in Braun and Dwenger (2019) (Appendix A) for changes between 1939 and 1950. We replicate their description in the following and extend the list of counties merged to also account for border changes between 1950 and 1970.

We first merge counties which, at any time between 1939 and 1970, formed one county. The counties of Hildesheim and Marienburg, for instance, were separate entities in 1939, but were merged to join the new county of Hildesheim-Marienburg in 1946. Consequently, the 1946 and 1950 censuses only contain data on Hildesheim-Marienburg. We thus merge Hildesheim and Marienburg already in the 1939 census. We proceed analogously for the counties of Bremerhaven and Wesermünde; city and rural districts of Bremen; Rhein-Wupper Kreis and Leverkusen; Kreis der Eder, Kreis des Eisenberges and Kreis der Twiste; city and rural districts of Konstanz; Coburg and Rodach bei Coburg; city and rural districts of Dinkelsbühl; city and rural districts of Donauwörth; city and rural districts of Göttingen; Gifhorn and Wolfsburg; Kempen-Krefeld and Viersen; city and rural districts of Herford; city and rural districts of Lüdenscheid; city and rural districts of Siegen.

In addition, there were some smaller border changes, in which municipalities were moved from one county to another. To deal with these border changes, we first compare the 1939 population of each county in its 1950 borders to the 1939 population of the same county in its 1939 borders. Since the majority of administrative borders remained unchanged between 1939 and 1950, the 1939 population figure is usually the same regardless of whether we use 1939 or 1950 borders. Moreover, we do not take any action if the difference between the two population figures is less than 5%. If the difference is larger than 5%, we merge the counties that exchanged municipalities. This applies to the counties of Osterholz, Verden and Bremen; Bergstraße, city and rural districts of Worms; Goslar, Wolfenbüttel and Salzgitter; Mainz, Groß-Gerau and Wiesbaden; Böblingen, Eßlingen and Stuttgart; city and rural districts of Osnabrück; city and rural districts of München; city and rural districts of Kulmbach; Lörrach and Neustadt; Norden and Emden; Braunschweig and Peine; city and rural districts of Erlangen; Sinsheim and Heilbronn; city and rural districts of Schwabach; Grevenbroich and Kempen-Krefeld; Bonn and Rhein-Siegkreis; Bielefeld, Paderborn and Wiedenbrück; Detmold and Höxter; Hamm and Unna; Meschede and Olpe; Beckum and Soest; city and rural districts of Ingolstadt.

Finally, we drop counties that have lost or gained more than 5% of its 1939 population to regions outside West Germany, in particular to counties in the Soviet Occupation Zone. These counties include Blankenburg (Rest); Helmstedt; Birkenfeld; Zweibrücken; Saarburg; Trier; Mellrichstadt; Osterode; rural and city districts of Lüneburg.

G Data sources

TABLE G1: Data Sources

Variable	Description and data source
Dependent variables	
Population growth 1950-70	Population change 1950-70 over population in 1939, based on Statistisches Bundesamt (1974). Data on 1970 population for Schleswig-Holstein come from Statistsches Landesamt Schleswig-Holstein (1971) and for Rhineland Palatinate from Statistisches Landesamt Rheinland-Pfalz (1967) as well as Statistisches Landesamt Rheinland-Pfalz (1968).
Migration rate 1950-70	Net migration 1950-70 over population in 1939, based on Statistisches Bundesamt (1974).
Main explanatory and instrumental variable	
Expellee inflow rate 1950	Expellees in 1950 over the population in 1939, based on Statistisches Bundesamt (1952).
Expellee inflow rate 1946	Expellees in 1946 over the population in 1939, based on Statistisches Amt des Vereinigten Wirtschaftsgebietes (1950).
Control variables	
Share of damaged dwellings	Share of dwellings built before 1945 that were damaged in the war, based on Statistisches Bundesamt (1956).
Rubble per capita	Untreated rubble at the end of the war over the population in 1939, based on Deutscher Städtetag (1949).
Loss in housing space	Classifies the loss in housing space in four categories, ranging from 'no losses' (1) to 'very substantial losses' (4). This indicator is taken from Institut für Raumforschung (1955).
Pop. density 1939	Population in 1939 (in 100) per square kilometer, based on Statistisches Bundesamt (1974).
Population share in cities with at least 10,000 inhabitants in 1939	The 1939 share of population living in cities with at least 10,000 inhabitants, based on Statistisches Reichsamt (1940).
Dummies for size of largest city in the local labor market in 1939	Dummies for counties that are located in a local labor market with a city of between 100,000 and 250,000 inhabitants and more than 250,000 inhabitants in 1939, based on Statistisches Reichsamt (1940).
Share agriculture 1939	The share of the workforce in agriculture in 1939, based on Statistisches Reichsamt (1943). Additional controls for the sectoral and occupational employment structure are also based on Statistisches Reichsamt (1943).
Turnover p.c. 1935	Turnover in 1935, taken from Statistisches Reichsamt (1939), over the workforce in 1939, taken from Statistisches Reichsamt (1943).
0/1 Inner-German border	Dummy for whether a county is located within 75 kilometers of the inner-German border.
Population growth 1871-1910 (1910-39, 1925-39)	Population change 1871-1910 (1910-39, 1925-39) over the population in 1871 (1910, 1925), based on various publications of the statistical agencies of the federal states.