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JEL classification: J61, J21, C36, N34.

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Sebastian Braun* Michael Kvasnicka†

June 23, 2012

Abstract

Does immigration accelerate sectoral change towards high-productivity sectors? This paper uses the mass displacement of ethnic Germans from Eastern Europe to West Germany after World War II as a natural experiment to study this question. A simple two-sector model of the economy, in which moving costs prevent the marginal product of labor to be equalized across sectors, predicts that immigration boosts output per worker by expanding the high-productivity sector, but decreases output per worker within a sector. Using German district-level data from before and after the war, we find strong empirical support for these predictions.

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1 Introduction

An efficient labor market requires labor to flow to those segments of the economy where it is most productive, i.e., it requires a high degree of regional, occupational, and sectoral mobility. For structural change, sectoral mobility is of particular importance. Flows of labor from low- to high-productivity sectors increase overall output and they help to offset productivity and wage differences within an economy. In practice, worker mobility is often too low to eliminate sectoral productivity differences. Immigrants, however, may respond stronger to sectoral differences in economic opportunities. If so, immigration can increase the efficiency of the labor market and boost output per worker by accelerating sectoral change towards high-productivity sectors.

We study the effect of immigration on sectoral change and output per worker in the context of one of the largest population movements in modern history, the mass displacement of ethnic Germans from Eastern Europe to West Germany after World War II.[1] For several reasons, this mass displacement provides a very interesting setting for investigating the relationship between immigration, sectoral change, and growth in output. First, regional differences in inflow rates of expellees were not driven by economic opportunities, and therefore provide an exogenous source of variation we can exploit to identify the effects of immigration. Second, expellees were not a selected sub-sample of the sending population and, as ethnic Germans, were close substitutes to native West Germans. Differences in sectoral mobility between the two groups are therefore unlikely to arise from differences in socioeconomic characteristics. And third, early post-war West Germany had considerable scope for productivity- and output-enhancing sectoral change (Broadberry, 1997; Temin, 2002). Compared to Great Britain, still Europe's powerhouse at the time, Germany had a large and unproductive agricultural sector. At the same time, labor productivity in manufacturing and services in Germany matched or even excelled that in Britain.

To derive testable predictions on the effects that expellees had on sectoral change and

[1] The displacement involved at least 12 million Germans. See Connor (2007) for a detailed account of the exodus. The mass displacement of ethnic Germans has only recently gained attention among economists. Bauer et al. (2011) and Falck et al. (2011) analyze the economic integration of the displaced in post-war West Germany, whereas Braun and Mahmoud (2011) studies the employment effects of the expellee inflows for native West Germans.

output, we first set up a simple model of a small open economy with two sectors, an agricultural and a non-agricultural sector. Switching jobs is assumed to be costly, so that arbitrage (via labor mobility) is not perfect and differences in the marginal products of labor between sectors need not disappear. As all immigrants have to find a new job upon arrival, their choice of sector is independent of the switching cost. Consequently, all migrants seek employment in the sector that offers them the highest return. Our model therefore predicts that immigration increases the employment share of the high-productivity sector (prediction 1). Concerning economy-wide output per worker, immigration has two countervailing effects. First, it decreases marginal productivity per worker within a sector. This within-sector effect, which is well known from the one-sector textbook model of a competitive labor market, decreases economy-wide output per worker (prediction 2). Second, it increases the employment share of the high-productivity sector. This between-sector effect increases economy-wide output per worker (prediction 3). The total or net effect of immigration on economy-wide output per worker is therefore ambiguous and depends on the size of the productivity difference between the two sectors and the slopes of their labor demand curves.

In our empirical analysis, we use German district-level data from before and after the war to test the predictions of our theoretical model. Specifically, we correlate regional inflow rates of expellees with the change in the non-agricultural employment share and the growth in turnover per worker (our proxy for economic activity) between 1939 and 1950. We also decompose the growth in turnover per worker into a within-sector and a between-sector component. The within-sector component represents the growth in turnover per worker between 1939 and 1950 that is attributable to growth in turnover within the two sectors, holding the sectoral employment shares constant at 1939 levels. The between-sector component represents the growth in turnover per worker that is attributable to changes in the relative employment shares of the two sectors, holding turnover per worker in the two sectors constant at 1939 levels. Simple OLS estimates from regressions that condition on pre-war regional differences in economic conditions suggest that an increase in the share of expellees by one percentage point increased (the change in) the non-agricultural employment share by 0.3 percentage points, decreased the within-sector component of growth in

turnover per worker by 0.8 percentage points, and increased the between-sector component by 0.4 percentage points. All three predictions from our theoretical model therefore receive empirical support. IV regressions, which exploit variation in the geographical proximity of origin and destination regions of expellees to predict expellee inflows, confirm our OLS results, as do a number of robustness checks. In particular, we show that pre-war trends in the outcome variables at district level are uncorrelated with regional inflows of expellees. Furthermore, we provide some evidence that the positive effect of expellee inflows on sectoral change was still present in the medium to long run.

Our results are most closely related to the seminal work by Borjas (2001). In his paper, Borjas argues that immigrants respond stronger than natives to regional differences in economic opportunities. Immigration, as a consequence, can improve labor market efficiency and accelerate wage convergence between regions. Using US census data from 1950 to 1990, Borjas shows that new immigrants tend to cluster in those state-education cells which offer them the highest wages. He also finds that wage convergence across US states is faster in high-immigration periods. In a similar spirit, Schündeln (2007) presents evidence for Germany that immigrants react stronger than natives to regional wage and employment differentials (even after controlling for individual characteristics). Using German micro data, Schündeln estimates that the unobserved costs of moving between German states are about 2.7 times larger for natives than they are for immigrants. Røed and Schøne (2012) analyze the sensitivity of immigrants and refugees to regional labor market disparities in Norway. They distinguish between the settlement pattern of newly arrived immigrants, their subsequent regional mobility during their stay in Norway, and their eventual exit to abroad. The authors find that immigrants, at all three stages, respond stronger to regional differences in economic opportunities than natives (if the latter respond at all).

In contrast to the existing literature, we analyze the effects of immigration into different regions on the inter-sectoral allocative efficiency of labor within regions. Moreover, we investigate also the effect that immigration has on aggregate economic activity. Finally, and important for identification, our specific historical setting allows us to abstract from a number of rival explanations for why immigrants may react stronger than natives to

sectoral differences in economic opportunities. Above all, it excludes the possibility of potential self-selection of inherently more mobile or productive individuals as migrants.[2] Observed differences in the (post migration) sectoral mobility of migrants and natives in our historical setting can therefore more convincingly be read as evidence that immigrants are less than otherwise comparable natives attached to a particular labor market segment, be it defined by region, by occupation or as – in our case – by sector.

The remainder of the paper is organized as follows. Section 2 provides the historical background. It documents Germany's economic structure at the eve of World War II and reviews the mass displacement of Germans that set in in its final stages. Section 3 introduces a simple two-sector model of a small open economy and derives theoretical predictions on the effects that immigration has on sectoral change and output. Sections 4 and 5 present the empirical strategy and the data we use. Section 6 presents the results, and Section 7 concludes.

2 Historical background

The sectoral employment structure in pre-war Germany: At the eve of World War II, Germany lagged dramatically behind Britain in the transition from an agrarian economy. In the German Reich, 25.9 per cent of the work force (or more than 8.9 million people) were still employed in agriculture (Länderrat des Amerikanischen Besatzungsgebiets, 1949). In Britain, in contrast, the respective share was little more than five percent. Germany's labor productivity in agriculture was also well below Britain's: in 1935, it reached just 57.2 per cent of the British level (Broadberry, 1997). In most other sectors, however, and most notably in manufacturing and professional/personal services, labor productivity in Germany matched or even excelled that in Britain.

Why was Germany lagging behind Britain at mid-century in its transition from an agrarian economy – despite the sizeable and obvious potential that existed for profitable

[2] Almost all ethnic Germans in Eastern Europe were forced to leave their homelands after World War II. Expellees therefore did not represent a selected subgroup of these societies. Speaking the same mother tongue (German), and having been educated in German schools, expellees were furthermore close substitutes to native West Germans (Bauer et al., 2011; Braun and Mahmoud, 2011).

sectoral change?[3] Part of the answer is surely to be found in the fact that Germany started its industrialization later than Britain. But this is not the whole story. Economic policies also played a role. In fact, from the late 1870s onwards, Germany actively sought to protect its agricultural sector from international competition (Britain, in contrast, abolished protectionist measures early on). In the following inter-war years, Germany's transition from an agrarian economy was further slowed down by the erection of new barriers to international trade (Temin, 2002). In combination, these factors made post-World-War-II Germany inherit a still large and comparatively unproductive agricultural sector. This misallocation of resources (and the heavy war destruction of its industry and infrastructure) kept labor productivity in Germany at comparatively low levels. However, it also provided ample opportunities to increase economy-wide labor productivity and boost economic growth by moving inefficient labor out of agriculture (Broadberry, 1997; Temin, 2002).[4]

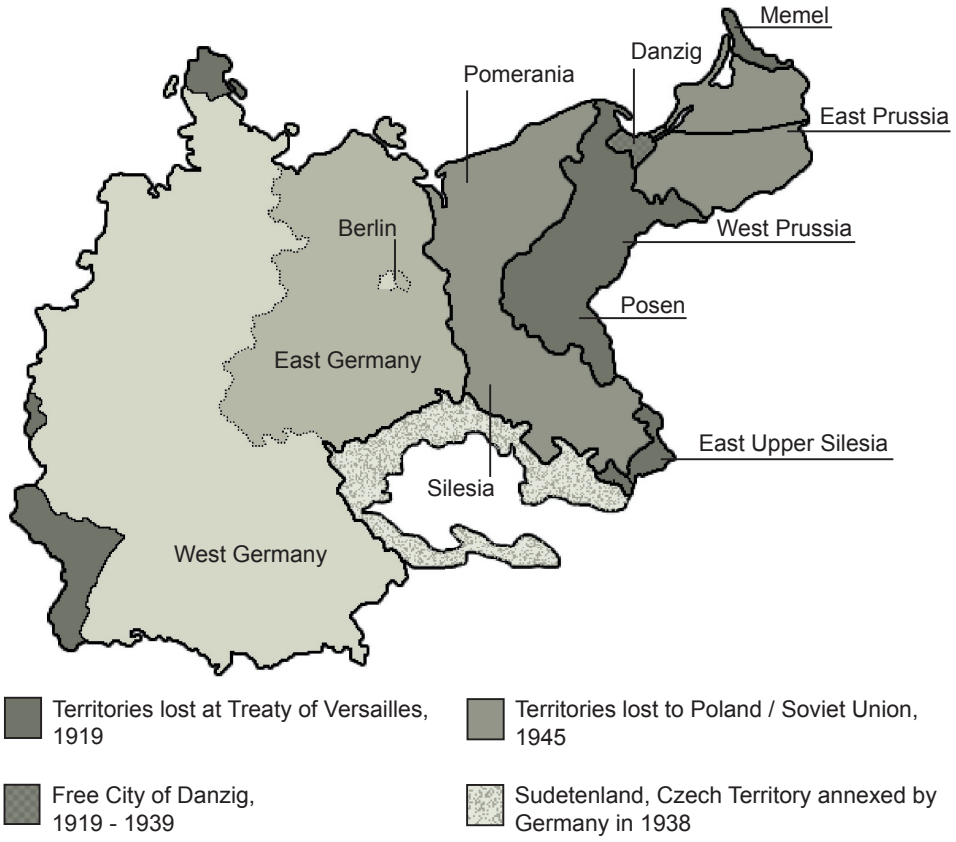
The displacement of ethnic Germans: The mass exodus of ethnic Germans from Eastern Europe began in the autumn of 1944 when Soviet troops began to advance westwards ever more rapidly. After Nazi Germany's unconditional surrender in May 1945, 'wild expulsions' followed, mainly in Poland and Czechoslovakia where civilian populations had suffered greatly during the German occupation. The Potsdam Agreement of August 1945, concluded between the United States, the United Kingdom, and the Soviet Union, legalized

[3]Also at the individual level, a change of sector (out of agriculture) appears to have been quite profitable in pre-war Germany. Although the monetary incentives of leaving agriculture are difficult to quantify, existing wage data suggests that agricultural workers and laborers could have earned substantially higher wages outside agriculture. Married agricultural workers earned, on average, a *yearly* salary of Reichsmark (RM) 698 in cash plus RM 715 in kind in 1937 (Statistisches Reichsamt, 1940). For unmarried agricultural workers, farm laborers, maidservants and milkers, the average salary drops to just RM 672 in cash plus RM 273 in kind. In contrast, high-skilled workers (*Facharbeiter*), semi-skilled workers (*Angelernte Arbeiter*), and unskilled workers (*Hilfsarbeiter*) in the metal working industry earned, on average, 55.91, 48.65 and 37.98 RM *per week* in 1938 (if paid by piece). So even an unskilled worker in the metal working industry had to work for only 37 weeks to match the yearly salary of a married agricultural worker.

[4]Most economic historians agree that the structural shift out of agriculture contributed to Germany's rapid economic growth after World War II. The relative importance of this structural shift, however, is still disputed. Eichengreen and Ritschl (2009), for instance, acknowledge that the downsizing of agriculture had a positive effect on economic growth in post-war Germany, but argue that the large and negative shock of the war itself, which pushed Germany off its long-run trend, was more important. This is in contrast to, e.g., Temin (2002) who argues that structural change was the single most important factor for the so-called Golden Age of European Economic Growth after World War II.

and sanctioned these expulsions. It also called for the orderly transfer of the remaining German populations in the territories east of the Oder-Neisse line that Germany had to cede and which were put under Polish or Soviet control (see Figure 1). Most of these 'organized expulsions' took place in 1946. They continued, though on a much smaller scale, in the years thereafter and were essentially over by 1950. The German territory west to the Oder-Neisse line (the new border) was divided into four zones of occupation: a British, a French, an American and a Soviet zone. The three Western zones were merged on 23 May 1949 to form the Federal Republic of Germany.

Figure 1: German Territorial Losses in World War I and II and Sudetenland



In September 1950, German expellees totaled 7.9 million and accounted for 16.5 percent of the West German population.[5] Expellees were very unevenly distributed across West

[5]In addition, around one million refugees from the Soviet occupation zone lived in West Germany. The war had also uprooted some native West Germans who fled the bombing of their home towns or the fighting

German regions. Their population share ranged from less than 4 percent in the district of Trier to almost 35 percent in the district of Lüneburg (see Table A1 in the Appendix for a tabulation of the respective shares in all 36 West German districts). There are three main reasons for these large regional differences. First, expellees who had fled the approaching Red Army in the final stages of World War II tended to gather in the most accessible West German regions, i.e., in those regions that were closest to their former homelands. In part, this concentration in the nearest save havens was inspired by the initial desire of many expellees to return home after the war. Second, the Allies' attempt to secure an equitable distribution of expellees across occupation zones was largely frustrated by deficient administrative structures in destroyed Germany and, in particular, the initial French refusal to admit any expellees to their zone of occupation (the French had not participated in the Potsdam conference and did not feel bound by its concluding agreement). And finally, the severe shortage of housing in West German cities, which existed already before the war, had been massively exacerbated by the Allies' heavy bombing campaigns. A disproportionate number of expellees thus settled or was transferred to the countryside, where most of the housing stock had remained intact (Connor, 2007). The uneven regional distribution of expellees in the immediate aftermath of World War II proved to be very persistent over time, as the occupying powers severely restricted the ability of Germans to change residence in the first post-war years.[6]

German expellees and native West Germans were arguably close substitutes on the West German labor market. The ceded Eastern provinces, where most expellees had lived before the war, had been an integral part of the German Reich.[7] Most expellees and natives therefore had lived in the same country prior to World War II. Both groups shared common cultural features and spoke German as their mother tongue. Both also had been educated in German schools and exhibited virtually identical (average) levels of education (Bauer

on the ground.

[6]In fact, relocations were initially banned altogether. Although this total ban on relocations was loosened in 1947, it was not until the foundation of the Federal Republic of Germany in May 1949 that general freedom of movement was restored (Ziemer, 1973).

[7]A significant number of expellees also came from the Sudetenland, which had become a part of the independent Czechoslovak state after the collapse of the Austro-Hungarian Empire. The Sudetenland was annexed by Nazi Germany in 1938. Some expellees also came from territories that the German Reich had lost already after its defeat in World War I.

et al., 2011). This homogeneity is rarely found in other migration episodes (and analyses thereof). The same holds true for the fact that expellees were not a selected sub-group of the sending region (all Germans east to the Oder-Neisse line were forced to leave their homelands). These features and the exogenous large regional differences in inflow rates are very important for analytical reasons because they aid the identification of the causal effects that the inflow of expellees to West Germany had on the pace of sectoral change and output growth.

In retrospection, there were strong reasons to expect that the arrival of expellees would delay, rather than accelerate sectoral change from the primary to the secondary and tertiary sectors. Before the war, expellees had worked to a far larger extent in agriculture than native West Germans.[8] As a consequence, one could have expected them to seek employment again disproportionately in the agricultural sector upon arrival in West Germany. In fact, the German administration actively fostered the re-integration of expellees into agriculture and provided tax incentives for the lease or purchase of farms under the 'Expellee Land Resettlement Law' (*Flüchtlingssiedlungsgesetz*) of 1949. As we will see, however, things turned out quite differently.

3 Theoretical considerations

To derive testable predictions on the effects on output and the sectoral employment structure in West Germany of the massive inflow of expellees after World War II, we consider a simple two-sector model of a small open economy. We first introduce the basic structure of the model and then provide a comparative-static analysis of the impact that immigration has on equilibrium output and on sector-specific employment shares.

Model setup: We consider two sectors, agriculture (A) and non-agriculture (N). Agricultural production uses the inputs labor (L) and land (Z), and non-agricultural production uses labor (L) and capital (K). Labor is hence employed in both sectors, while land is used

[8] In 1939, the agricultural employment share in the German Reich was 25.9 percent. In its eastern territories, this share exceeded 40 percent (Länderrat des Amerikanischen Besatzungsgebiets, 1949).

only in agriculture and capital only in the non-agricultural sector. The supply of both land and capital is assumed to be fixed. The respective production functions for the two sectors are:

$$y_a = f_1(L_a, Z) \text{ with } f_{1L} \equiv \frac{\partial f_1}{\partial L_a} > 0, f_{1LL} \equiv \frac{\partial^2 f_a}{\partial^2 L_a} < 0, \tag{1}$$

$$y_n = f_2(L_n, K) \text{ with } f_{2L} \equiv \frac{\partial f_2}{\partial L_n} > 0, f_{2LL} \equiv \frac{\partial^2 f_n}{\partial^2 L_n} < 0, \tag{2}$$

where y_a and y_n are the output levels of the agricultural and the non-agricultural good, and L_a and L_n denote the respective labor employed in the two sectors. The assumed fixed supplies of land and capital entail diminishing returns to scale in both sectors. The prices for the agricultural good, p_a, and the non-agricultural good, p_n, are determined in world markets and are exogenous. Product and factor markets are perfectly competitive. Labor (as well as land and capital) is hence paid its sector-specific marginal product, that is:

$$w_a = p_a f_{1L}, \tag{3}$$

$$w_n = p_n f_{2L}, \tag{4}$$

where w_a and w_n denote the respective wage rates in the agricultural and in the non-agricultural sector.

In the long run, labor is perfectly mobile and wage rates will equalize across sectors (i.e., $w_a = w_n$). In the short run, however, adjustment costs can drive a wedge between sector-specific wage rates.[9] We assume that there is a fixed cost θ associated with finding a new job or switching between jobs. Once employed in a sector, workers will only change sectors, therefore, if the sectoral wage differential is larger than θ. Without loss of generality, we restrict the analysis to the case, in which wages are at least as high in the non-agricultural sector as in agriculture (i.e., $w_n \geq w_a$). An agricultural worker therefore has no incentive

[9]Such adjustments costs may reflect actual job finding costs or the cost of adopting to a new work environment. Note that we abstract from the cost of switching sectors, as such costs would require us to make assumptions on the working history of immigrants. In practice, sector-specific human capital will make it more costly to switch jobs between than within sectors. As expellees were over-represented in agriculture before the war, sector-specific human capital will work against our hypothesis that immigration accelerated sectoral change away from low-productivity agriculture.

to seek employment in the non-agricultural sector if w_n exceeds w_a by at most θ. In other words, the no-arbitrage condition in this labor market is:

$$w_n \leq w_a + \theta. \tag{5}$$

Finally, we assume that there are L workers of whom each supplies inelastically one unit of labor. The full employment condition in this economy is therefore:

$$L_a + L_n = L. \tag{6}$$

Figure 2 illustrates how the four equilibrium conditions (3), (4), (5), and (6) can be solved for the respective allocations of labor to the two sectors. The horizontal axis in the figure measures total labor supply L in the economy. Agricultural employment is measured from origin 0_a, and non-agricultural employment from origin 0_n. To see how the presence of adjustment costs can drive a wedge between factor-specific wage rates, consider first point B in Figure 2. Given the marginal product curves $p_a f_{1L}$ and $p_n f_{2L}$, point B is a long-run equilibrium and wages are equalized across sectors at $w_a = w_n$. Now suppose that sector-specific technological change shifts out the marginal product curve in the non-agricultural sector to $p_n f'_{2L}$ so that wages in this sector increase from w_n to w'_n. Without adjustment costs, worker would re-allocate to the non-agricultural sector and the new equilibrium would be in point C. With adjustment costs, however, workers will only re-allocate if the gain in wages associated with such a switch of sectors is larger than its costs. As drawn in Figure 2, adjustment costs exactly offset the potential wage gain and no worker moves out of agriculture into the non-agricultural sector.[10] Wages will hence not equalize across sectors. Instead, the productivity shock will entail a permanent wage differential, equal in magnitude to the fixed cost θ, between the non-agricultural and the agricultural sector of the economy. Economy-wide (nominal) output in this case is given

[10]The no-arbitrage condition therefore holds with equality and labor allocation is determined by $w_a = p_a f_{1L} = p_m f_{2L} - \theta = w_m - \theta$ (from equations (3), (4) and (5)). If the wage increase in the non-agricultural sector is larger than θ, workers will leave agriculture until the no-arbitrage condition will hold again with equality. If the wage increase in the non-agricultural sector is smaller than θ, no worker will leave agriculture and the no-arbitrage condition will hold as an inequality.

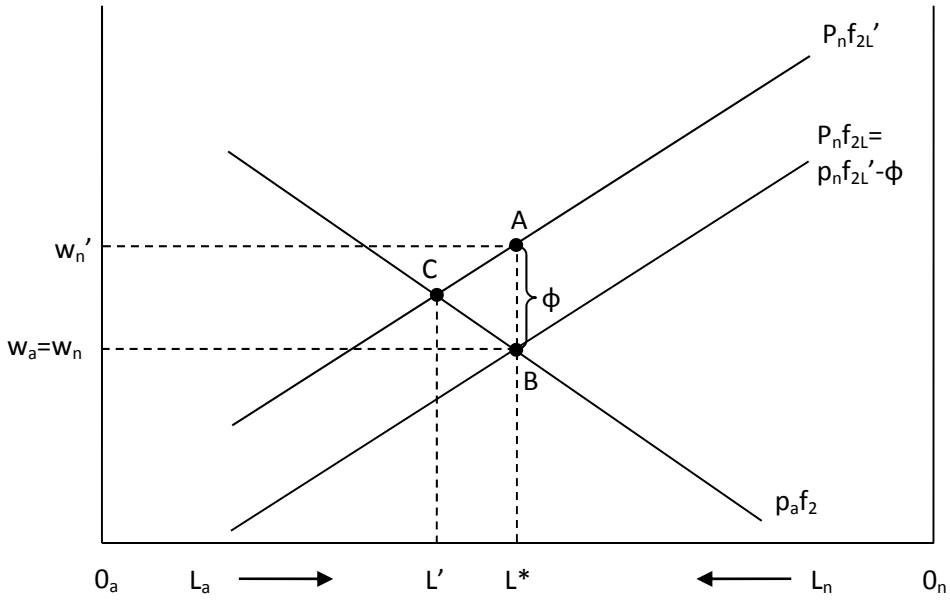


Figure 2: Labor allocation

by $p_a f_1(L_a, Z) + p_m f_2(L_m, Z)$. This output level is lower (by the area in the triangle ABC) than the level of output that would have materialized in the absence of adjustment costs.

Immigration and its effects: We can now analyze the effects of immigration on the sectoral employment shares and on output per worker in the economy.[11] In line with the literature, we assume that migrants do not bring with them any input factors other than their manpower.[12] Immigrants are identical to natives in production. However, all immigrants, by definition, gave up (or lost) their jobs at home and need to seek new employment upon arrival. All immigrants therefore have to pay the fixed adjustment cost θ, irrespective of the sector to which they actually move. Immigration increases the labor force in the economy. This increase is equal to the size of the migrant inflow. Assume the inflow, or change in the stock of migrants in the economy, is of size ΔM. As shown in

[11]The welfare effects of immigration for native workers are discussed in Appendix A.1. In particular, the Appendix shows that in an economy with re-distribution, the effects of immigration on economy-wide output per worker are also of interest to the welfare of native workers. Intuitively, if immigration increases output per worker, it will also increase the size of the pie that is available for re-distribution.

[12]As expellees arrived in post-war Germany with hardly any possessions at all, this assumption is most likely justified in the specific historical episode we investigate.

Figure 3, this inflow expands the horizontal axis and moves its origin to $0'_n$. The shift of the origin also entails a rightward shift in the marginal product curve of the non-agricultural sector.

What happens to the sectoral employment structure of the economy? Upon arrival, migrants will enter the sector that offers them the highest return (as all migrants have to pay the adjustment costs irrespective of their choice of sector). Migrants will therefore seek employment in the non-agricultural sector, which drives down wages in this sector. As long as the migration inflow is not too large, and w_n does not fall below w_a, all migrants will end up working in the non-agricultural sector. As drawn in Figure 3, the migration inflow equalizes wage rates in the two sectors (the new equilibrium is again in point B). Labor employed in agriculture is unchanged, while labor employed in the non-agricultural sector has increased by exactly the number of migrant workers. If the migration inflow is smaller than the one drawn in Figure 3, a wage differential between the two sectors will still exist. All migrants, however, will again work only in non-agricultural employment. If the migration inflow is larger than the one depicted in Figure 3, some migrants will also move to agriculture. Wages rates will again equalize, but now through downward adjustment not only of wages in the non-agricultural sector, but also of wages in agriculture. In each of these three cases, however, migration will increase the employment share of the non-agricultural sector, i.e., the employment share of the sector in which the marginal product of labor is initially higher. It is in this sense that immigration can foster structural change towards the high-productivity sector.

How does immigration affect nominal output per worker (or GDP per worker)? Output per worker, in the following denoted by Ω, is simply the sum of agricultural and non-agricultural production divided by the labor force:

$$\Omega = \frac{p_a f_1(L_a, Z) + p_n f_2(L_n, Z)}{L_a + L_n}. \tag{7}$$

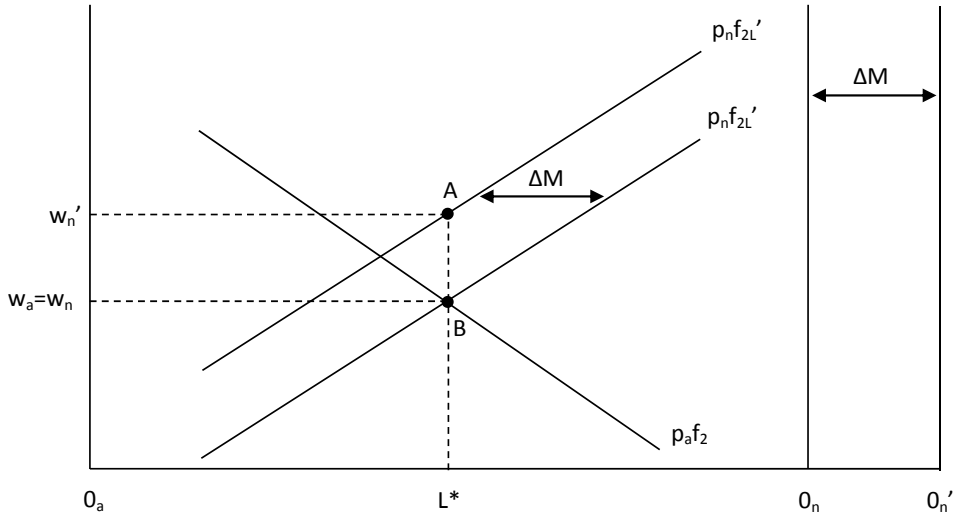


Figure 3: The Effects of Migration

This can be re-written as:

$$\begin{aligned}\Omega &= \frac{p_a f_1(L_a, Z)}{L_a}\frac{L_a}{L_a + L_n} + \frac{p_n f_2(L_n, Z)}{L_n}\frac{L_n}{L_a + L_n} \\ &= \omega_a s_a + \omega_n s_n, \end{aligned} \tag{8}$$

where ω_a (ω_n) is per worker output, and s_a (s_n) the share of workers in the agricultural (non-agricultural) sector. Economy-wide output per worker is therefore equal to the weighted sum of sector-specific outputs per worker (the weights are the sector-specific employment shares). Assuming $w_m > w_a$, the effect of a marginal increase in the stock of migrants on economy-wide output per worker can be decomposed into two parts:

$$\frac{\partial \Omega}{\partial M} = \overbrace{\frac{\partial \omega_n}{\partial M} s_n}^{within} + \overbrace{\frac{\partial s_n}{\partial M}(\omega_n - \omega_a)}^{between}. \tag{9}$$

The first component, or *within-sector* effect, is negative and well known from the textbook model of a competitive labor market with just one sector: an immigration-induced increase in labor supply decreases marginal and therefore also average productivity per worker *within* an industry. In our two-sector model, a marginal increase in immigration

will affect only the supply of labor to the better paying (non-agricultural) sector. It is hence only in this sector that the within-industry effect will materialize. The second component, or *between-sector* effect, in contrast, is positive and arises only if productivity differs initially between the two sectors. If this is the case, immigration will increase the relative employment share of the better paying sector and thereby increase (ceteris paribus) economy-wide output per worker. The overall or net effect of immigration on output per worker is therefore ambiguous. If the initial difference in productivity between the two sectors is sufficiently high, and/or the labor demand curve in the better paying non-agricultural sector is sufficiently flat, however, immigration may well increase, rather than decrease, economy-wide output per worker.[13]

Summarizing the preceding discussion, our model provides a number of testable predictions, which we can evaluate for the massive immigration to West Germany of ethnic Germans that have been displaced from Eastern Europe after World War II:

H1: *Immigration increases the employment share of the high-productivity sector.*

H2: *By expanding the high-productivity sector, immigration ceteris paribus increases economy-wide output per worker (between-sector effect).*

H3: *Immigration decreases output per worker within sectors. This ceteris paribus decreases economy-wide output per worker (within-sector effect).*

4 Empirical strategy

We want to learn what effects (if any) the immigration of displaced Germans had on the sectoral employment structure and on output per worker (as well as its within- and between-sector components) in post-war West Germany. For identification of these effects, we

[13]Most empirical studies on the labor market effects of immigration find no or only very small wage effects of immigration, which suggests that the labor demand curve is essentially flat. A positive overall effect of immigration on output per capita is therefore more than just a theoretical possibility. See Friedberg and Hunt (1995), Okkerse (2008), Longhi et al. (2010), and Kerr and Kerr (2011) for reviews and meta-analyses of the literature.

exploit regional variation in expellee inflow rates across West German districts. Estimation is by OLS (conditional and unconditional) and IV.

OLS estimation: We start with estimating simple OLS regressions of the following type:

$$y_{i50-39} = \alpha + \beta m_{i50} + x_{i39}\gamma + u_i, \tag{10}$$

where y_{i50-39} is the change in an economic outcome, e.g. output per worker, in district i between 1939 and 1950, m_{i50} is the population share of expellees in district i in 1950, x_{i39} is a vector of control variables for 1939 characteristics of district i, and u_{i50} is an error term. Since there lived, by definition, no expellees in West Germany in 1939, m_{i50} is equal to the change in the expellee share between 1939 and 1950, i.e., the inflow of expellees in these years. Equation (10) therefore effectively relates, at the level of districts, *changes* in economic outcomes to *changes* in the population share of expellees, and thus differences out (potentially unobserved) time-invariant district characteristics.

To test the predictions of our theoretical model, we consider four outcome variables, each measured at district level:[14] (i) the change in the non-agricultural employment share between 1939 and 1950 ($\Delta(L_n/L)$), (ii) the growth in output per worker between 1939 and 1950 ($\Delta\Omega$)[15], (iii) the between-sector component of this growth in output per worker ($\Omega_{between}$), and (iv) the within-sector component of growth in output per worker (Ω_{within}). Our theoretical model predicts that immigration increases the non-agricultural employment share in a district. It also predicts that immigration increases district-level output per worker through a between-sector effect, but decreases it through a within-sector effect. As a consequence, the overall effect on district-level output per worker, $\Delta\Omega$, is ambiguous. To obtain measures of the between-sector and the within-sector component, we need to decompose our data on the overall growth in output per worker between 1939 and 1950. In this data decomposition, we distinguish, as in the theoretical model, between the agricultural and the non-agricultural sector (the latter hence includes both the secondary and

[14]Time subscripts on variables are omitted in the following for easier reading.

[15]In fact, we will use turnover per worker to proxy for output per worker. The problems (and virtues) of this proxy are discussed in the next section.

the tertiary sector). Using the notation we used in Section 3, growth in output per worker in district i can be decomposed as follows:[16]

$$\frac{\Delta\Omega_i}{\Omega_{i39}} = \overbrace{\frac{\Delta\omega_{ia}s_{ia39} + \Delta\omega_{in}s_{in39}}{\Omega_{i39}}}^{within} + \overbrace{\frac{\Delta s_{ia}\omega_{ia39} + \Delta s_{in}\omega_{in39}}{\Omega_{i39}}}^{between} + \underbrace{\frac{\Delta s_{ia}\Delta\omega_{ia} + \Delta s_{in}\Delta\omega_{in}}{\Omega_{i39}}}_{residual} \tag{11}$$

$$\equiv \Omega_{i,within} + \Omega_{i,between} + \epsilon_i, \tag{12}$$

where Δ denotes the change in a variable between 1939 and 1950, Ω_{i39} is district-wide output per worker, s_{ij39} the employment share of sector $j = \{a, n\}$ in district i in 1939, and ω_{ij39} its per-worker output in the same year. $\Omega_{i,within}$ denotes the within-sector component and $\Omega_{i,between}$ the between sector component of the growth in output per worker in district i between 1939 and 1950.[17] As shown in equation (11), the within-sector component represents the growth in output per worker between 1939 and 1950 that is attributable to changes in output per worker within the two sectors, holding their respective employment shares constant at 1939 levels. In other words, it gives the growth in output per worker had employment shares stayed constant. From our model, we expect the within component to be negatively correlated with expellee inflows. The between-sector component, in turn, represents the growth in output per worker that is attributable to changes in relative employment shares of the two sectors, holding output per worker in the two sectors constant at their 1939 levels. It hence gives the growth in economy-wide output per worker had output per worker stayed constant. As shown in Section 3, the between sector component is positive if (and only if) the employment share of the (initially) more productive sector expands. We expect the between component to be positively correlated with expellee inflows.

[16] Recall from the previous section that output per worker can be written as the weighted sum of sector-specific output levels per worker, where the weights are the respective employment shares of the two sectors, i.e., $\Omega = \omega_a s_a + \omega_n s_n$.

[17] The third component in the decomposition of per worker output growth in equation (12), i.e., ϵ_i, is a residual or interaction term and represents the growth in output per worker that is attributable to simultaneous changes in the labor productivity and the employment share of a sector. This residual is larger, the more correlated are employment shifts and within-sector changes in labor productivity.

To account for regional differences in economic conditions before the war, i.e., before the actual inflow of expellees, we use a number of district-level control variables in our regression analysis. These include the 1939 share of workers that are employed in agriculture, the 1939 level of output per worker in agriculture, the 1939 level of output per worker in the non-agricultural sector, and a dummy for the city states of Hamburg and Bremen. As explained in Section 2, expellees were over-proportionally transferred to districts where sufficient housing was available to accommodate them. Such districts were mostly rural and agricultural in nature, as it was only in such districts that housing had remained largely intact during the war. These agricultural districts might have experienced faster sectoral change than other (less agricultural) districts, even in the absence of immigration of expellees. To account for this potentially confounding influence, we control for pre-war differences between districts in the relative importance of agricultural employment. The two controls for pre-war output per worker (in agriculture and in the non-agricultural sector) will furthermore pick up any regional differences in sector-specific labor productivity that existed already before the war; and the dummy for Hamburg and Bremen will take account of the very specific circumstances encountered in these two city states (which comprise only urban areas).[18]

IV estimation: Controlling for pre-war district employment structures and productivity may not suffice for identifying the causal effects of immigration on sectoral change and output per worker. If there are unobserved factors that induce the non-agricultural sector in a district to expand and, at the same time, correlate positively with its population share of expellees, we will overestimate the true effect that immigration has on sectoral change, that is the expansion of the non-agricultural sector. In the present context, a particular source of concern is the possibility that an expansion of the non-agricultural sector in a district (for reasons unrelated to migration) might have attracted expellees in search for work. We consider this possibility a rather unlikely event (especially when we condition in our regression analysis on pre-war district differences in agricultural employment). As explained in greater detail in Section 2, the initial location of expellees after World War II

[18]Both Hamburg and Bremen had almost no agriculture in 1939 and were largely destroyed during the war. As a consequence, they hosted only relatively few expellees.

was hardly driven by local economic conditions, and the mobility of expellees and natives was severely restricted by law in the immediate post-war period. However, moving restrictions did gradually phase out and were eventually abolished completely. At least a fraction of workers, therefore, may have re-located by 1950 on the basis of unobserved factors that also affected the speed of sectoral change in a district.

To check for the importance of any such self-selection (and hence potential bias in our OLS estimates), we run IV regressions. Our instrument for the 1950 population share of expellees in a receiving district uses information on both the distances between origin and destination regions and the population share of different origin regions in the total population of all origin regions in 1939 (the origin regions are the former Eastern territories of the German Reich, the destination regions the West German districts). Expellees initially fled mainly to those West German districts that were close to their old homelands.[19] Such patterns of expellee inflows, which were driven by geographical distance, are unlikely to be related to (underlying) sectoral employment changes between 1939 and 1950. The instrument we use to predict the population share of expellees in destination district i in 1950 is therefore defined as follows:

$$Instrument_i = \sum_s \left(dist_{is} \times popshare_{s39} \right), \tag{13}$$

where $dist_{is}$ is the distance between the administrative capitals of the receiving district i and the sending district s, and $popshare_{s39}$ is the share of the sending district's population in the total population of all sending districts in 1939.[20] This instrument is therefore the weighted sum of all geographic distances between a receiving district and all sending districts, where the 1939 populations of the sending districts serve as weights.

[19]For instance, Germans from the Sudetenland mostly fled to districts in neighboring Bavaria. As a result, they accounted for the majority of expellees in a district such as Upper Palatinate (*Oberpfalz*) that directly bordered the Sudetenland. In contrast, expellees from the Sudetenland were a tiny minority in the district of Schleswig-Holstein, which is located in the North of Germany, far away from the Sudetenland. Schleswig-Holstein, in turn, faced large inflows of expellees from East-Prussia which was connected to Schleswig-Holstein through the Baltic Sea.

[20]The sending districts are Königsberg, Gumbinnen and Allenstein in East Prussia, Breslau, Liegnitz and Oppeln in Silesia, Stettin and Köslin in Pommerania, Frankfurt, Danzig, Memel Territory, and the Sudetenland.

5 Data

For our empirical analysis, we use pre- and post-war data for all 36 districts of West Germany in their 1950 borders.[21] Data on agricultural and non-agricultural employment (shares) in 1939 and 1950 are taken from the population and occupation censuses of 17 May 1939 and 13 September 1950.[22] Employment shares refer to all economically active individuals, irrespective of whether they are employed or unemployed at the date of a census. To construct these shares, unemployed individuals are assigned to their last sector of employment when still in work. Data on the number of expellees and residents (total population) in a district are also taken from the 1950 census.[23]

District-level data on production is not available for the time period under investigation. We therefore use data on total turnover, in and outside agriculture, which we take from published turnover tax statistics (Statistisches Reichsamt, 1939; Statistisches Bundesamt, 1955). Total turnover is defined as domestic deliveries and other services of a business for money and own consumption of the business. Notwithstanding potential caveats, such as exemptions for businesses with low turnover, total turnover is the most viable proxy for local production that is available over time and also disaggregated by sector (Vonyó, 2012). Although generated turnover is not a direct measure of the production value, it correlates strongly with national income.[24] Turnover statistics are not available for 1939. We therefore use data for 1935. To obtain a measure of turnover per worker, we divide total turnover in the agricultural and non-agricultural sector in 1935 (1950) by the sector-specific labor force in 1939 (1950). Turnover per worker in 1939 is hence measured with (potentially

[21] Table A1 in the Appendix provides a list of these districts and the federal states they are located in. It also documents their expellee population shares in 1950 and their 1939-1950 changes in the non-agricultural employment share. In 1950, neither the Saarland nor West Berlin were yet part of West Germany. They are therefore excluded from the analysis.

[22] Data for both censuses comes only in printed format. The 1939 data is taken mainly from Länderrat des Amerikanischen Besatzungsgebiets (1949). Exceptions are the districts Niederbayern, Oberpfalz, Oberfranken and Mittelfranken, and Lindau. For these districts, data is taken from Bayerisches Statistisches Landesamt (1953). Data for 1950 is sampled from several publications of the statistical offices of the West German states. A documentation of the sectoral employment structure of West Germany based on the results of the 1950 census is provided in Statistisches Bundesamt (1956).

[23] The census defines expellees as German nationals or ethnic Germans who on 1 September 1939 lived in either the former German territories east to the Oder-Neisse line or abroad.

[24] The correlation coefficient between turnover per capita in 1935 and national income per capita in 1936 is 0.92 for the 19 regions of the German Reich, for which both type of data are available.

considerable) error; and so is the change in turnover per worker between 1939 and 1950, which is one of the dependent variables we consider. However, as this measurement error affects only the dependent variable, it does not bias our estimates, but only inflates standard errors.

6 Empirical results

6.1 Baseline results

Our main regression results are reported in Tables 1 and 2. Table 1 provides estimates of the impact of immigration on sectoral change between 1939 and 1950, and Table 2 estimates of its impact on growth in turnover per worker (overall, between- and within component) in the same period. For both OLS and IV estimates in these tables, we report robust standard errors.

With respect to sectoral change, column 1 of Table 1 shows that the share of expellees is positively, and statistically significantly, correlated with the growth in the non-agricultural employment share in a district. In other words, the more expellees settled in a district, the more did non-agricultural employment expand in total district employment.[25] The unconditional OLS estimate implies that an increase in the 1950 expellee share by one percentage point increased the change in the non-agricultural employment share by 0.26 percentage points. This simple univariate OLS regression has remarkably high explanatory power ($R^2 = 0.47$). Figure 4, which shows the corresponding regression line on the scatter plot of the dependent and independent variable, illustrates that the relationship between both variables is approximately linear in nature and not driven by outliers. Controlling for pre-war district characteristics, and city-state status of Hamburg and Bremen, has little effect on the statistical relation between the size of the expellee inflow and the scale of the sectoral change that occurs in a district (see column 2 of Table 1). Adding these controls only increases, albeit substantially, the R^2 of the regression.

[25] Consistent with our finding, a recent unpublished master thesis finds expellee inflows to correlate positively with employment growth in industry and crafts between 1925 and 1950 (see Kramer, 2012).

Table 1: Main Results I - Immigration and sectoral change 1939-50

	OLS (1)	**OLS** (2)	**IV** (3)
Expellee share	.0026***	.0028***	.0028***
	(.0005)	(.0004)	(.0004)
First Stage:			
Weighted distance			-.0662***
			(.0074)
F-Statistic			79.57
R^2	.4657	.8127	.8126
Covariates	no	yes	yes

Notes: Estimates are based on 36 observations. The dependent variable is the change in the non-agricultural employment share between 1939 and 1950. Covariates are the 1939 employment share in agriculture, 1939 turnover per worker in the agricultural and the non-agricultural sector, and a dummy for the city states of Hamburg and Bremen. *** denotes statistical significance at the 1%-level. Robust standard errors are in parentheses.

The OLS estimates reported in the first two columns of Table 1 will be biased if, conditional on pre-war characteristics, expellees' allocation across districts was not orthogonal to underlying district trends in sectoral reallocation. Although the scope for potential self-selection of expellees into different regions was very limited in the aftermath of World War II (see Section 2), we address this potential source of bias formally by instrumenting the actual population share of expellees in a district by the district's weighted sum of geographic distances to all sending regions.

The first stage of the IV regression shows that our instrument is strongly and significantly correlated with actual expellee inflows (the F-statistic is high and well above conventional thresholds for weak instruments). As expected, the further away a West German district is located from the former Eastern territories of the German Reich, the smaller was its intake of expellees. The (second-stage) IV estimate of our key explanatory variable is identical to the conditional OLS estimate (see column 3 of Table 1). This similarity of OLS and IV estimates suggests that selection into districts was largely exogenous to (unobserved) local labor market conditions. In particular, there is no evidence that expellees tended to settle more in districts with an above average trend growth in non-agricultural

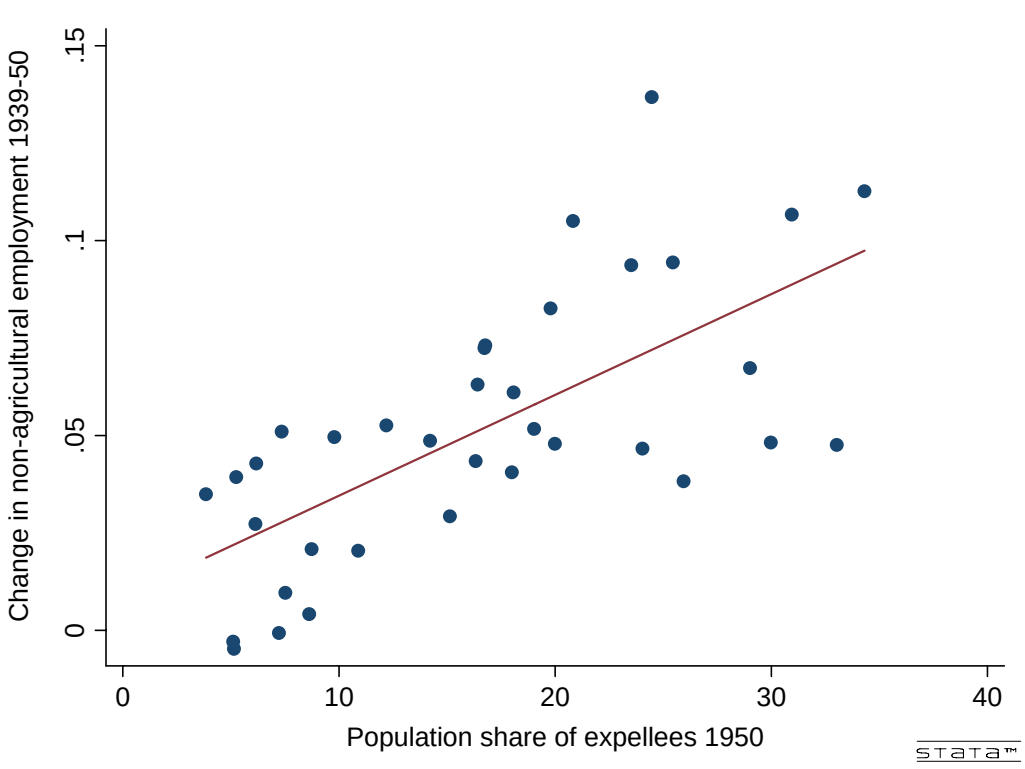


Figure 4: Immigration and sectoral change 1939-50

employment. The findings reported in Table 1 therefore provide evidence in support of our first hypothesis (*H1*).

Table 2 documents our results for growth in turnover per worker. Again, we consider three specifications: unconditional and conditional OLS, as well as IV regressions. As predicted by our model (see *H2*), the between component of growth in turnover per worker is positively correlated with the inflow of expellees into a district (see first row of Table 2). The unconditional OLS estimate suggests that a one percentage point increase in the expellee share increased the between component of growth in turnover per worker by 0.33 percentage points. The estimated magnitude of the effect is slightly larger in the two other specifications. The within component of turnover growth, in contrast, is negatively correlated with the inflow of expellees (see second row estimates). This finding is also consistent with our model (*H3*). In the unconditional OLS regression, a one percentage point increase in the expellee share is associated with a decrease in the within component

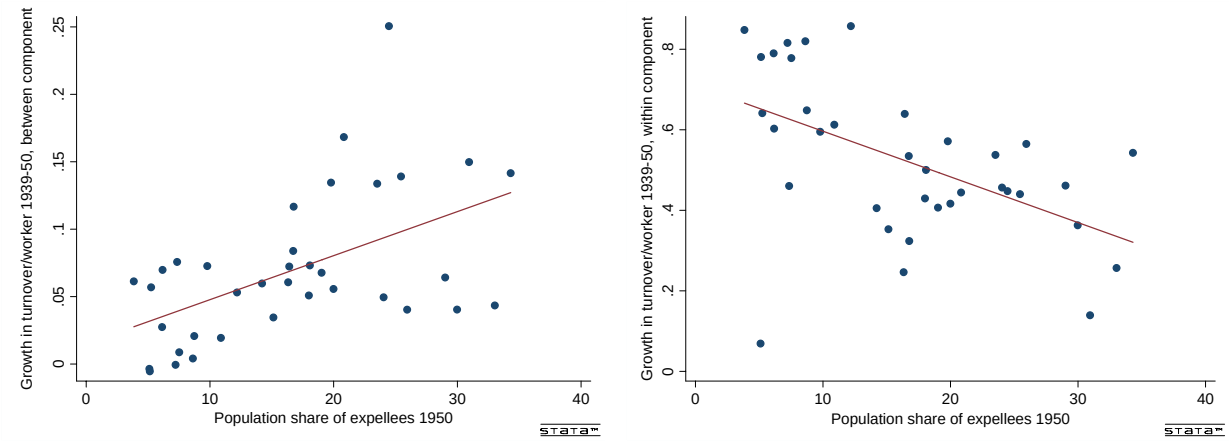
of growth in turnover per worker of 1.13 percentage points. Estimates are only modestly smaller in the conditional OLS and IV regressions (although statistically insignificant in the former). Scatter plots of the population share of expellees in 1950 and the between and within components of turnover growth are provided in Figure 5 (along with the estimated unconditional OLS regression lines between these variables). Again, the plots are suggestive of a sizeable (given the spread in the data) and approximately linear relationship between each pair of data that is not (at least in its sign) driven by outliers.

Table 2: Main Results II - Immigration and growth in turnover per worker 1939-50

	OLS (1)	**OLS** (2)	**IV** (3)
Growth in turnover/worker, between	.0033***	.0036***	.0038***
	(.0010)	(.0007)	(.0008)
Growth in turnover/worker, within	-.0113***	-.0083	-.0109***
	(.0037)	(.0050)	(.0042)
Growth in turnover/worker, overall	-.0074*	-.0040	-.0064
	(.0041)	(.0055)	(.0047)
Covariates	no	yes	yes

Notes: Estimates are for the expellee share and based on 36 observations. Each estimate stems from a separate regression. Covariates are the 1939 employment share in agriculture, 1939 turnover per worker in the agricultural and the non-agricultural sector, and a dummy for the city states of Hamburg and Bremen. ***,* denotes statistical significance at the 1%-, and 10%-level, respectively. Robust standard errors are in parentheses.

Growth in overall turnover per worker is the sum of the between and the within component of growth in turnover (plus a residual term). Since the negative within-sector effect of immigration is larger (in absolute terms) than the positive between-sector effect, we find immigration to be negatively correlated with overall growth in turnover per worker (see third row of Table 2). However, only in the unconditional OLS specification is this estimated negative correlation statistically significant (recall that our model does not provide a prediction on this correlation).



(a) Between component

(b) Within component

Figure 5: Immigration and growth in turnover per worker 1939-50

6.2 Robustness checks

We conducted several tests to assess the robustness of our findings. First, we ran placebo regressions, both conditional OLS and IV, which relate *pre-war* trends in each outcome variable to post-war expellee inflows. For identification, expellee inflows at district level must be uncorrelated with underlying trends in outcomes. Naturally, this common trend assumption cannot be tested. However, we can check if expellee inflows at district level are uncorrelated with past (pre-war) trends in district-level outcomes. In our placebo regressions, we relate the 1925-1939 sectoral change and growth in turnover per worker, as well as its between- and within-sector components, to the 1950 population share of expellees in a district, controlling as before for district characteristics in the base year (now 1925) and for city state status (Hamburg and Bremen).[26] Estimated coefficients of the expellee share in these placebo regressions are provided in Table 3. Evidently, and reassuringly, pre-war changes in all outcome variables turn out to be uncorrelated with the relative magnitudes of post-war inflows of expellees. The results of these placebo regressions therefore provide supportive evidence for our identifying assumption that expellee inflows (and the weighted distance term we use to instrument inflows) were indeed exogenous.

[26]Labor force statistics for 1925 are from the population and occupation census of 16 June 1925 and are taken from Hohls and Kaelble (1989). Data on turnover refer to 1926 and are published in Statistisches Reichsamt (1931).

Table 3: Robustness Check I - Placebo regressions, 1925-39

			Growth in turnover/capita					
	Sectoral change		between		within		overall	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exp. share	.0004	.0002	-.0002	-.0004	-.0006	-.0007	-.0006	-.0012
	(.0005)	(.0004)	(.0008)	(.0006)	(.0030)	(.0021)	(.0027)	(.0022)

Notes: Estimates are based on 36 observations. Covariates are the 1925 employment share in agriculture, 1925 turnover per worker in the agricultural and the non-agricultural sector, and a dummy for the city states of Hamburg and Bremen. The F-statistic of the first stage in the IV regressions is 79.57. Robust standard errors are in parentheses.

Second, we added fixed effects for each of the 16 West German states to our regression models and used only the within-state variation to identify the effects of immigration on sectoral change and output per worker. By doing so, we account for potential unobserved factors at the state level that simultaneously affected a district's growth in turnover, respectively sectoral change, and its intake of expellees.[27] For instance, economic conditions might have evolved systematically different in West German states at or close to the new inner-German border. If so, the exclusion restriction of our distance-based instrument may not be satisfied.[28] Adding state fixed effects also comes at a price, as it removes most of the 'good' variation in the data (regressing the 1950 population share of expellees on state dummies gives an R^2 of 0.8297). Nevertheless, as shown in Table 4, the estimated coefficients in the sectoral change and between component regressions remain highly statistically significant and even become a bit larger in magnitude. Furthermore, the relationship between immigration and the within component is still negative (albeit now imprecisely estimated). Overall, state fixed-effects regressions therefore largely corroborate the results of our baseline regressions.

Third, we replaced the expellee share in 1950 by the expellee share in 1946 to assess the robustness of our findings to the use of alternative dates for measuring the immigration

[27]Note that state fixed effects also control for unobserved factors at the occupation zone level.

[28]Note, however, that there is no obvious reason why states close to the border, which experienced over-proportionally large expellee inflows, should have experienced faster sectoral change.

Table 4: Robustness Check II - Regressions with state dummies

			Growth in turnover/capita					
	Sectoral change		between		within		overall	
	OLS	**IV**	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exp. share	.0037***	.0037***	.0044***	.0046***	-.0016	-.0115	.0045	-.0051
	(.0004)	(.0006)	(.0009)	(.0011)	(.0088)	(.0096)	(.0100)	(.0106)

Notes: Estimates are based on 36 observations. Covariates are the 1939 employment share in agriculture, 1939 turnover per worker in the agricultural and the non-agricultural sector, and a full set of state dummies. The F-statistic of the first stage in the IV regressions is 22.6. *** denotes statistical significance at the 1%-level. Robust standard errors are in parentheses.

Table 5: Robustness Check III - Regressions with 1946 expellee share as dependent variable

			Growth in turnover/capita					
	Sectoral change		between		within		overall	
	OLS	**IV**	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exp. share	.0025***	.0026***	.0033***	.0035***	-.0083*	-.0101**	-.0044	-.0059
	(.0004)	(.0004)	(.0006)	(.0008)	(.0043)	(.0040)	(.0047)	(.0044)

Notes: Estimates are based on 36 observations. Covariates are the 1939 employment share in agriculture, 1939 turnover per worker in the agricultural and the non-agricultural sector, and a full set of state dummies. The F-statistic of the first stage in the IV regressions is 108.3. ***,**,* denotes statistical significance at the 1%-, 5%-, and 10%-level, respectively. Robust standard errors are in parentheses.

shock.[29] The expulsions of Germans were largely carried out in the course of 1946, a year in which moving restrictions were still in force. The 1946 distribution of expellees is therefore even less likely to have been affected by endogenous location choices than the 1950 distribution. However, both in the sectoral change and the turnover regressions, estimated coefficients are again very similar to those of our baseline regressions (see Table 5). Our findings therefore also do not depend on the year, in which we measure the immigration

[29]The 1946 data comes from the population and occupation census of 29 October 1946, as reported in Statistisches Amt des Vereinigten Wirtschaftsgebietes (1950) and Ausschuss der deutschen Statistiker für die Volks- und Berufszählung 1946 (1949). Unfortunately, 1946 data is not available for the five districts of Rhineland-Palatinate. We approximated the expellee share in these five districts by the state-level average of Rhineland-Palatinate in 1946.

shock.

6.3 Medium- and long-run effects

So far, our analysis has been restricted to the short-run effects of the mass inflow of expellees to West Germany on the pace of sectoral change and on growth in output per worker. In this section, we investigate also its medium- and long-run effects. For lack of data, however, we have to restrict our analysis to the effects of immigration on sectoral change.[30] Specifically, we re-run our conditional OLS and IV regressions, but use as dependent variables the changes in the non-agricultural employment share between 1939 and 1961 and between 1939 and 1970.[31] The explanatory variable of interest is again the population share of expellees in 1950. We thus analyze whether the initial (very uneven) distribution of expellees had a longer lasting effect on the pace of sectoral change at district level. The results are reported in Table 6.

Table 6: Further results - Immigration and sectoral change 1939-61/70

	Sectoral change 1939-61		**Sectoral change 1939-70**	
	OLS	**IV**	**OLS**	**IV**
	(1)	(2)	(3)	(4)
Expellee share in 1950	.0012***	.0009*	.0001	-.0002
	(.0004)	(.0005)	(.0006)	(.0006)
R^2	.9183	.9165	.9566	.9563
Covariates	yes	yes	yes	yes

Notes: The dependent variables are the change in the non-agricultural employment share between 1939 and 1961 (columns (1) and (2)) and between 1939 and 1971 (columns (3) and (4)). Covariates are the 1939 employment share in agriculture, 1939 turnover per worker in the agricultural and the non-agricultural sector, and a dummy for the city states of Hamburg and Bremen. ***,* denotes statistical significance at the 1%-level and 10%-level, respectively. Robust standard errors are in parentheses.

[30] Data on turnover per worker that are comparable over time are only available until 1955.

[31] Data on (relative) employment levels in the non-agricultural sector are taken from the population and occupation censuses of 6 June 1961 and 27 May 1970 (Hohls and Kaelble, 1989), which are the first two censuses after the 1950 census.

Consider first the effect of immigration on the change in the non-agricultural employment share between 1939 and 1961 (see columns 1 and 2 in Table 6). In both regressions, the estimated coefficient of the 1950 population share of expellees is positive and statistically significant. The unequal inflow of expellees to different administrative districts in West Germany therefore appears to have had a longer lasting effect on the pace of district-level structural change. However, the conditional OLS estimate (reported in column 1) is less than half the size and the IV estimate (column 2) only a third the size of the short-run effect we estimated for the period 1939-1950. By 1961, the effect of expellee inflows on the non-agricultural employment share was therefore already attenuated. And it completely vanished by 1970, as shown in columns 3 and 4 of Table 6. The pace of sectoral change between 1939 and 1970 therefore did not differ between districts that had experienced initially high and low inflows of expellees.[32]

Such a gradual attenuation, and eventual disappearance, of the effect of immigration on the pace of district-level sectoral change is to be expected if migrants eventually re-locate more than natives in response to regional differences in economic opportunities. If labor is subject to decreasing returns, migrants will re-locate from initially high-immigration districts to low-immigration districts. These flows tend to level regional differences in population shares of expellees and they accelerate the pace of sectoral change in initially low-immigration districts, which induces a catch-up process. Aggregate statistics broadly support this line of reasoning. Between 1950 and 1961, the population share of expellees decreased (increased) markedly in districts that initially produced less (more) in per capita terms and that initially had a high (low) population share of expellees.[33] These patterns are in line with the empirical evidence on the regional mobility of immigrants and na-

[32]This does not imply that the inflow of expellees had no effect on long-run sectoral change for the whole of West Germany. In fact, evidence from German micro-level data suggests that it most likely did have an impact. Bauer et al. (2011) show that expellees were much more likely than natives to work outside agriculture even in 1971. Among individuals born between 1906 and 1925, displaced men (women) had a 67% (78%) lower probability than natives to work in agriculture. Bauer et al. also show that these differences in sectoral affiliation carried over, albeit attenuated, to the second generation of expellees.

[33]In a simple unconditional OLS regression, an increase in the 1950 turnover per capita by DM 1000 is associated with a 0.39 percentage points (standard error of 0.11) increase in the expellee share between 1950 and 1961. Moreover, a one percentage point increase in the 1950 expellee share in a district is associated with a 0.39 percentage points (standard error of 0.05) reduction in the expellee share. The 1970 census does not contain population data on expellees.

tives (Borjas, 2001; Røed and Schøne, 2012; Schündeln, 2007). We also find that districts with high inflows of expellees between 1950 and 1961 tended to experience faster sectoral change.[34]

7 Discussion and concluding remarks

Does immigration accelerate sectoral change from low- to high-productivity sectors? This paper has studied this question in the context of the mass exodus of Germans from Eastern Europe to West Germany after WWII. This migration flow provides a particularly interesting historical episode for investigating the relationship between immigration, sectoral change, and growth in output. Not only was the inflow of expellees large, unexpected, and very unequally distributed across regions. West Germany had also inherited a large and unproductive agricultural sector and therefore exhibited considerable scope for productivity- and output-enhancing sectoral change.

To derive testable predictions for our empirical analysis, we first set up a simple two-sector model, in which moving costs prevent the marginal product of labor to be equalized across sectors. The model predicts that immigration accelerates sectoral change towards the high-productivity sector, as immigrants are less attached than natives to a specific labor market segment and therefore more responsive to sectoral differences in economic opportunities. By expanding the high-productivity sector, immigration increases economy-wide output per worker. However, by expanding labor supply, it also exerts a countervailing negative influence on economy-wide output, as it decreases labor productivity within a sector.

We used German district-level data from before and after WWII to test these predictions – and found strong support for them. The large-scale inflow of expellees fostered structural change away from low-productivity agriculture and thereby increased output per worker.

[34] A simple conditional OLS regression suggests that a one percentage point increase in the share of expellees between 1950 and 1961 increased the change in the non-agricultural employment share over the same period by 0.25 percentage points (standard error of 0.10). Covariates considered in this regression include the 1950 employment share in agriculture, 1950 turnover per worker in the agricultural and the non-agricultural sector, and a dummy for the city states of Hamburg and Bremen.

This positive effect on the between component of output growth, however, was not large enough, at least in the short run, to outweigh the negative effect of immigration on within-sector output growth. Overall, therefore, immigration had a negative (short-run) effect on growth in output per worker. However, expellees remained more mobile than natives also in the medium run, and moved out of low-productivity regions during the 1950s. Their long-run impact on output growth may therefore well have been positive.

Overall, the evidence presented in this paper suggests that immigration can increase labor market efficiency, as immigrants are less attached than natives to a particular labor market segment which makes them more responsive to differences in economic conditions. This benefit of immigration has largely gone unnoticed in policy debates, both past and present, on the labor market effects of immigration.

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A Appendix

A.1 Theoretical considerations

Immigration, Redistribution, and the Welfare of Natives: In the main text, we have shown that immigration increases the relative employment share of the high-productivity sector and potentially also output per worker. In this section, we explore the effects that immigration has on the welfare of the different types of natives in our model (that is, owners of labor, capital, and land).

Figure A1 provides a graphical analysis of the welfare effects of immigration. The additional labor employed in the non-agricultural sector decreases non-agricultural wages from w'_n to w_n. This reduces the wage bill of native non-agricultural workers by an amount equal to the area β. Native capital owners benefit from the lower wages in the non-agricultural sector and capture the respective area β in the form of additional producer surplus. Migration also increases total nominal output by the area $\alpha + \gamma$. Migrants receive area α in the form of wage payments, and capital owners receive γ, the immigration surplus. Agricultural workers and land owners are not affected by the migrant inflow.[35] At first glance, therefore, the effects of immigration for natives are identical to those derived in the standard model of a one-sector economy with fixed capital.

However, as shown in Section 3 in the main text, immigration may increase output per worker in a two-sector economy. This result is of importance for the welfare effects on natives if there is income re-distribution. The reason is simple: if immigration increases per capita output, it also increases the size of the pie that is available for re-distribution. Suppose, for instance, that both labor and capital income in the economy are taxed at rate t, that all tax revenues are re-distributed to workers, and that immigrant workers cannot be excluded from the re-distribution scheme. The net income of workers, i.e., their income after taxes and redistribution, then consists of their after tax factor income and their total tax transfers. The latter is just the tax rate times total nominal output divided by the

[35] Of course, this only holds true, if the inflow of migrants is sufficiently small and/or the initial wage differential is large enough so that all migrants move into the non-agricultural sector.

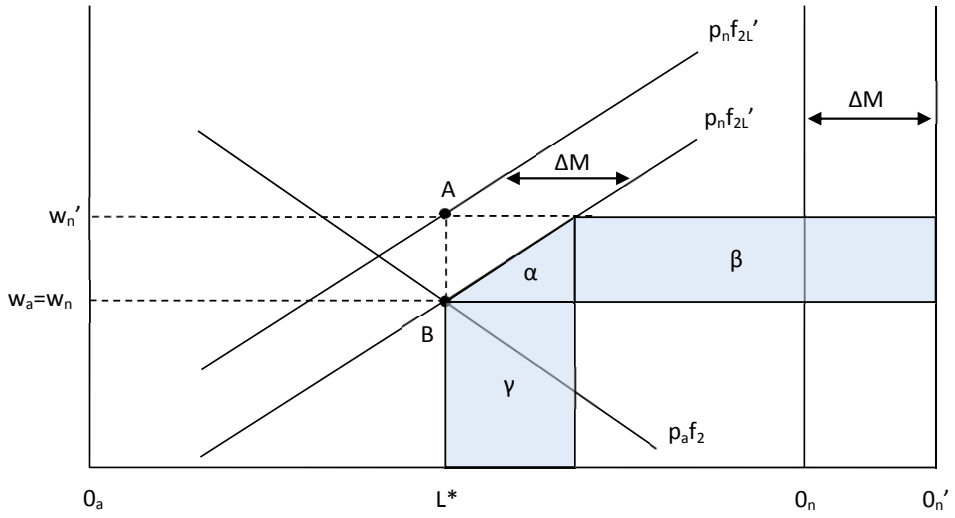

Figure A1: The Welfare Effects of Migration

number of workers, which is the same as the tax rate times output per worker. The net income of workers in the agricultural and non-agricultural sectors can therefore be written as:

$$(1-t)w_a + t\Omega,$$
$$(1-t)w_n + t\Omega.$$

If $t = 0$, workers will simply keep their factor incomes. If $t = 1$, workers in both sectors will have identical net incomes (independent of their actual factor incomes). In a welfare state that re-distributes income, the effect of immigration on the net income of native workers therefore does not only depend on immigrants' direct effect on factor incomes, but also on their effect on output per capita. In other words, if immigration does increase output per capita, it can well turn out to be Pareto improving for all groups in the economy. To see this interesting possibility, consider the net income of native workers in the non-agricultural sector, i.e. the net income of the only native group which experiences a loss in factor income as a result of immigration. The overall effect of a marginal increase in the

number of migrants on the net income of native workers in the non-agricultural sector is:

$$(1-t)\frac{\partial w_m}{\partial M} + t\frac{\partial \Omega}{\partial M},$$

which is positive for:

$$\frac{t}{1-t}\frac{\partial \Omega}{\partial M} > \frac{\partial w_m}{\partial M}.$$

A necessary (but not sufficient) condition for a positive effect of immigration on the net income of workers in the non-agricultural sector is therefore that immigration increases output per worker. Provided that immigration increases economy-wide output per worker, immigration will also increase the net income of workers in the non-agricultural sector if t is large enough and/or the labor demand curve in this sector is sufficiently flat.

A.2 Districts

Table A1: Districts: Inflows of expellees and sectoral change

District	State	Share of expellees in 1950 population [in %]	Change in non-agricultural employment share 1939-50
Schleswig-Holstein	Schleswig-Holstein	33.0	4.8
Hamburg	Hamburg	7.2	-0.1
Bremen	Bremen	8.6	0.4
Stade	Lower Saxony	30.9	10.7
Lüneburg	Lower Saxony	34.3	11.3
Hannover	Lower Saxony	25.9	3.8
Aurich	Lower Saxony	16.3	4.3
Oldenburg	Lower Saxony	24.0	4.7
Osnabrück	Lower Saxony	19.8	8.3
Braunschweig	Lower Saxony	30.0	4.8
Hildesheim	Lower Saxony	29.0	6.7
Detmold	North Rhine Westphalia	16.7	7.2
Münster	North Rhine Westphalia	12.2	5.3
Düsseldorf	North Rhine Westphalia	7.5	1.0
Aachen	North Rhine Westphalia	6.1	2.7
Cologne	North Rhine Westphalia	8.7	2.1
Arnsberg	North Rhine Westphalia	10.9	2.0
Kassel	Hesse	19.0	5.2
Darmstadt	Hesse	16.4	6.3
Wiesbaden	Hesse	15.1	2.9
Koblenz	Rhineland-Palatinate	5.2	3.9
Trier	Rhineland-Palatinate	3.8	3.5
Rheinhessen	Rhineland-Palatinate	5.1	-0.3
Pfalz	Rhineland-Palatinate	5.1	-0.5
Montabaur	Rhineland-Palatinate	6.2	4.3
Nordbaden	Baden-Württemberg	14.2	4.9
Südbaden	Baden-Württemberg	7.3	5.1
Südwürttemberg[1]	Baden-Württemberg	9.8	5.0
Nordwürttemberg	Baden-Württemberg	18.1	6.1
Unterfranken	Bavaria	16.8	7.3
Oberfranken	Bavaria	23.5	9.4
Mittelfranken	Bavaria	18.0	4.1
Oberpfalz	Bavaria	20.8	10.5
Niederbayern	Bavaria	24.5	13.7
Oberbayern	Bavaria	20.0	4.8
Schwaben	Bavaria	25.5	9.4

Notes: [1] includes Lindau. Altogether, there are 36 districts (located in nine federal states) in our estimation sample. Two districts are city states (Bremen and Hamburg). The mean share of expellees in 1950 district populations is 16.5%. The mean change in the non-agricultural employment share between 1939 and 1950 across districts is 5.2%.