LUND UNIVERSITY
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Internal migration and urban labor markets: evidence from expellee flows in West Germany in the 1950s

by

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Abstract This study evaluates the impact of expellee migration on urban labor markets in West Germany in the 1950s. By utilizing newly digitized data and empirically accounting for the spatial context, the results show that the migration of expellees played a significant role in accelerating sectoral change, while cities with a high initial inflow were impeded in the pace of sectoral change. The study therefore highlights the importance of an equitable geographical distribution of migrants such that they are able to meaningfully contribute to the local economy, as expellees did in West Germany in the 1950s.

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Liebe Oma und lieber Opa, ohne euch wäre diese Arbeit niemals entstanden.

Contents

List of Figures

List of Tables

1 Introduction

Forced migration can have various consequences for both the host and sending societies, as well as for migrating and native individuals. Becker and Ferrara (2019) recognize that "[f]orced migration is as common today (e.g. Syrian civil war refugees, Rohingya expelleed from Myanmar) as it was in history (e.g. mass population movements after WWII)" (Becker and Ferrara 2019, p.1). Therefore, it is crucial to understand the impact of past migration events in order to draw lessons for handling contemporary migration. Consequently, this study focuses on the expulsion of approximately 12 million expellees from the former East German provinces after the Second World War. Out of these, around 8 million expellees arrived in West Germany, which was the Federal Republic of Germany from 1949 to 1990, before reunification with East Germany. Initially, expellees were primarily settled in regions closer to the expulsion regions and in rural areas, as urban housing was largely destroyed during the war. However, during the 1950s, expellees started to migrate within West Germany in search of employment in other regions (Stahlberg 1957, p.17-18). By utilizing newly digitized data for urban labor markets in West Germany, this study analyzes the impact of these expellee migration flows on the employment structure of urban labor markets during the 1950s. The analysis focuses on the three major economic sectors of agriculture, manufacturing and services (Duarte and Restuccia 2010, p.134). Furthermore, the iron and metal production industry is included to provide a more comprehensive depiction of labor market developments. Importantly, multiple empirical approaches, including descriptive spatial analyses, multivariate regressions, and geographically-weighted regressions, are employed to assess the relationship between expellee migration flows and labor market developments. The geographically-weighted regression approach is particularly important as it accounts for the spatially varying relationships between expellee migration flows and labor market dynamics.

The results reveal that expellees had a profound impact on changes in the employment structure of West German cities during the 1950s. Regions experiencing a high initial influx of expellees faced challenges in integrating them due to the disproportionate burden on their economic capacity. In such regions, where industrial capacity was insufficient to accommodate all job-seeking expellees, agricultural employment shares increased, hampering a faster transition out of agriculture. Conversely, regions with a low initial inflow of expellees had higher industrial capacity and faced labor scarcity, which enabled expellees to find employment in the manufacturing sector, thereby driving a decline in agricultural employment shares and accelerating sectoral change. Therefore, the pace of transitioning out of the agricultural sector was heavily influenced by the absorption capacity of cities. Furthermore, the study reveals that expellee migration flows are associated with an increase in employment shares within the iron and metal production industry across West German cities, further contributing to the shift towards industrialization. Interestingly, urban areas experienced a decline in manufacturing shares, indicating a shift of manufacturing activities to rural areas and facilitating rural industrialization. Additionally, the results indicate a sectoral shift towards the services sector. In summary, the findings suggest that expellees were a significant proximate determinant in accelerating the structural transformation of urban labor markets in West Germany.

This study makes several contributions to the existing literature. First, I create a novel dataset by digitizing annual data on the employment shares of various occupation groups from 1950 to 1960. This dataset is then combined with digitized expellee data and supplemented with data from other sources. Furthermore, this study exclusively focuses on urban labor markets, which exhibit different labor market dynamics compared to rural areas. Lastly, conducting geographically-weighted regression analysis in GIS enables me to discern varying relationships across different regions, offering a more nuanced understanding of the relationship.

The study is structured as follows: Section 2 provides a summary of the historical background. Section 3 presents a review of the existing literature. In Section 4, I describe the digitization process, data and variables. Section 5 outlines the methodology. Section 6 presents the results of the descriptive spatial analysis, the baseline estimation and the geographically-weighted regression. In Section 7, I discuss the underlying mechanisms of the impact of expellee migration flows on the urban labor market. Section 8 concludes.

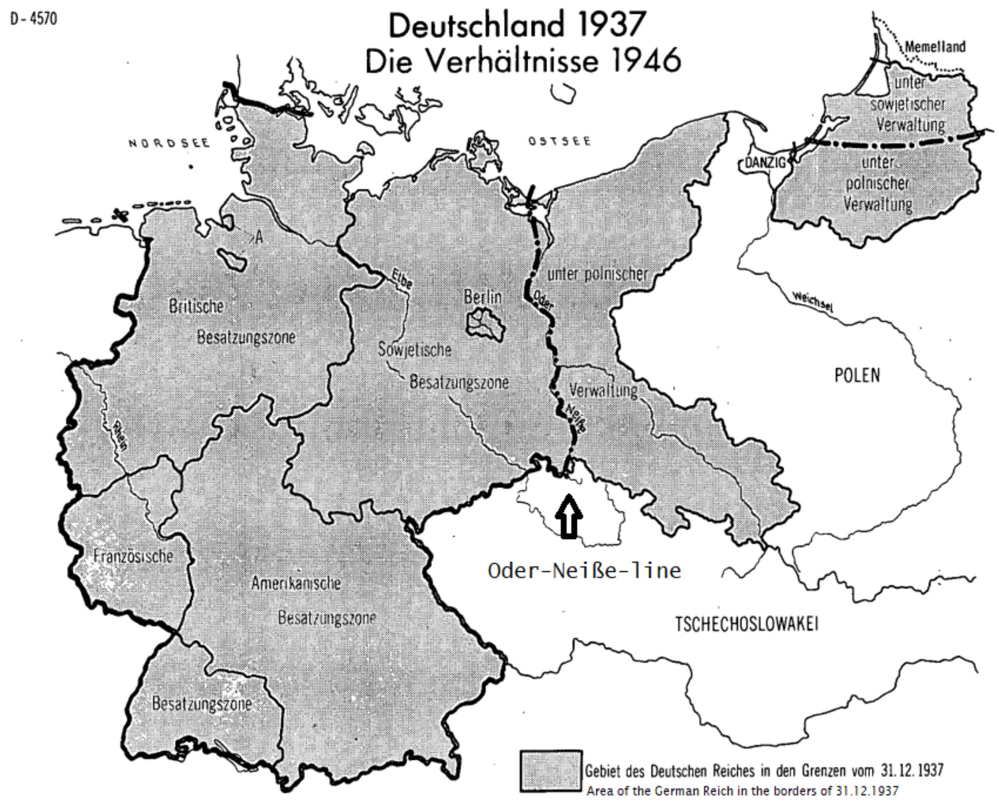
2 Historical background

2.1 Phase 1: Potsdam Agreement and Expulsion

After the Second World War, Germany had to cede its Eastern provinces[1] which accounted for approximately 24% of its land area in 1937 and had a pre-war population of around 10 million (Braun and Mahmoud 2014, p.74). As per the Potsdam Agreement of 1945, the Allies decided to shift Germany's eastern border westward to the Oder-Neiße line. Consequently, the inhabitants residing east of that line, as well as those from German settlement areas in Central European countries such as Czechoslovakia and Hungary, were required to be resettled. Figure 1 shows the territory of Germany in the borders of 1937 and its new borders in 1946.

[1] Ostpreußen, Schlesien, Ostpommern and Ostbrandenburg

Figure 1: Germany in the borders of 1937



Source: Statistisches Landesamt Schleswig-Holstein 1974
This map depicts Germany in the borders of 1937 and the situation in 1946, showing the occupation zones and post-war borders of Germany.
Note that this map was published in 1974 and the former East German provinces are still classified as 'under Polish/Soviet administration'. It was not until 1990 that the Federal Republic of Germany recognized the new border.

The displacement of ethnic Germans from the former Eastern provinces is commonly referred to as the expulsion, which commenced around 1944 when individuals, particularly from East Prussia, began fleeing from the advancing Soviet Union's Red Army. Millions of East Germans fled their homes, and with the Potsdam agreement in 1945, it became evident that these refugees could not return, effectively making them expellees (Statistisches Landesamt Schleswig-Holstein 1974, p.10-11). The Polish and Soviet administrations began forcibly evicting German residents east of the Oder-Neiße line in 1945. These mass evictions and the subsequent journey to Germany were dangerous. Consequently, the Allied governments initiated organized transfers of the remaining German population in 1946. Thus, the largest portion of the German population residing east to the Oder-Neiße line was expelled and arrived in Germany in 1946. In 1946, around 5.7 million expellees were recorded in the four occupation zones of Germany, which is the territory that is currently Germany. Additional transfers continued until 1951. The estimated total number of expellees who arrived in Germany has been estimated to be around 12 million people (Braun, Kramer, et al. 2021, p.235)[2].

Of these expellees, approximately 8 million arrived in West Germany, which was formed in 1949 of the British, American and French zone[3]. The West German population increased from 39.4 million in 1939 to 47.7 million in 1950. Additionally, around one million individuals migrated from the Soviet zone to West Germany (Braun and Mahmoud 2014, p.78).

Figure 2: Map of German states

The allocation of expellees was based on housing availability and geographic proximity to the former East German provinces, and they were not free to choose their destinations until 1949. This placed a disproportionate burden on the states (*Bundesländer*) in closer proximity to the former East German territories, namely Schleswig-Holstein, Niedersachsen and Bayern, which I will refer to as the high-inflow states. Despite accounting for only a

[2]Including expellees from the former East German provinces Ostpreußen, Ostpommern, Ostbrandenburg and Schlesien, as well as expellees from the former German settlement areas in the Baltic states, the Memel region, Danzig, Poland, Czechoslovakia, Hungary, Yugoslavia and Romania

[3]The Soviet occupation zone became the German Democratic Republic. In 1990, the German Democratic Republic and West Germany were reunited to form the Federal Republic of Germany

third of West Germany's pre-war population, these states hosted over 60% of all expellees by the end of 1949. The remaining West German states, namely Nordrhein-Westfalen, Hessen, Baden-Württemberg, Rheinland-Pfalz, Hamburg and Bremen, constitute the low-inflow states (see Figure 2). Besides housing availability and proximity to the former East German provinces, the occupation zone also influenced allocation. Initially, the French occupation zone refused to accept any newcomers since they had not been invited to the Potsdam Conference. Consequently, they did not feel obliged to adhere to the commitment made in the Potsdam Agreement to ensure an equitable distribution of expellees across occupation zones (Braun and Dwenger 2017, p.10-11). Thus, the significant disparity in the distribution of expellees across West Germany created a disproportionate burden on the high-inflow states, far exceeding their economic capacity in terms of housing availability, employment opportunities and fiscal capacity (Stahlberg 1957, p.17-18). Recognizing this issue, the necessity to redistribute expellees became evident. As a result, resettlement programs were implemented in 1949 to address the situation.

2.2 Phase 2: Resettlement program and voluntary migration

The resettlement of expellees occurred in two forms: government-organized transfers as part of a nationwide resettlement program (*Umsiedlung*), and voluntary migration (*Wanderung*).

The state-directed yet voluntary population transfer (*Umsiedlung*) was specifically aimed to relocate the displaced population from the high-inflow states to the remaining states of the Federal Republic. Early on, the disproportionately burdened states had sought such a resettlement program, but the lack of a centralized office had hindered any progress. It was only with the establishment of the Federal Government in 1949 that a larger-scale transfer of expellees became feasible, facilitated by a central plan implemented through various resettlement initiatives. The overarching objective of these resettlement efforts was to promote the economic integration of displaced individuals (Stahlberg 1957, p.17-18). This organized migration not only sought to align labor supply with job opportunities but also aimed to reunite separated family members. The initial state-directed migration measures were enacted in 1949, intending to resettle 300,000 expellees from the high-inflow states to states in the French occupation zone. In 1951, a second resettlement measure was passed, organizing the transfer of another 300,000 expellees from the main refugee states to the remaining states. Subsequently, in 1953, the third and fourth resettlement measures were implemented (Müller 1962, p.28-32). In total, 980,000 expellees were resettled through government-organized transfers (Statistisches Landesamt Schleswig-Holstein 1974, p.11).

However, the number of expellees resettled through government-organized transfers was soon surpassed by those who voluntarily migrated (*Wanderung*). A significant portion of the resettlement process occurred through free migration, becoming more important especially after the abolition of the migration prohibition in 1949. Free migration was not restricted to specific groups and was primarily determined by employment opportunities, which also influenced the direction of movement. The successful integration of expellees into the destination state's economic landscape depended significantly on their own initiative. From an economic perspective, free migration was highly favorable as it naturally led to a more balanced population distribution based on economic rationality (Stahlberg 1957, p.17-18). As early as 1951, a decline in resettlement transports and a rise in voluntary migration was observed (Statistisches Bundesamt 1952b, p.3). This migration flow of expellees during the 1950s resulted in a more equitable distribution of expellees across West German counties. After 1960, the internal migration of expellees was not recorded anymore.

3 Literature review

Becker and Ferrara (2019) present a comprehensive review of the literature on multiple forced migration movements, ranging from recent events like the Syrian civil war to historic events such as the Greco-Turkish war of 1919-1922. The findings reveal that often, it takes migrants several generations to fully integrate into the receiving population. However, these outcomes are heavily influenced by factors depending on the specific context, origin, and destination of the migration (Becker and Ferrara 2019, p.14-15). In light of this, I restrict the literature review to the specific context of the expulsion of Germans from the former East German provinces after the Second World War, aiming to present the particular findings of the impact of this migration event on economic outcomes.

Numerous studies have examined the impact of the expellee inflows on population density. Schumann (2014) finds that the settlement prohibition by the French occupation government resulted in a lower population density, which persisted even 20 years later. By utilizing municipality-level data from 1950 to 1970 for Baden-Württemberg and employing a spatial regression discontinuity approach, Schumann (2014) demonstrates that the settlement prohibition resulted in a sharp population discontinuity of more than 21 percent at the border between the French and neighboring American zone. Moreover, Schumann (2014, p.202-204) notes that in 1950, industrial activity and food stability were higher in the American zone, but these disparities did not persist over time. Peters (2022) analyzes the population density across all counties in West Germany and finds that the initial allocation of refugees was strikingly persistent, with counties experiencing high initial inflows remaining substantially larger even decades later. On average, a 10 percentage-point increase in the expellee share led to a 13% increase in the local population (Peters 2022, p.2369). Contrastingly, Braun, Kramer, et al. (2021) emphasize the significance of the chosen regional unit of observation. They distinguish between labor markets, a more aggregated regional level compared to municipalities or counties, and reveal that population shocks persist within labor markets but not between them. This discrepancy can be attributed to significant net migration flows occuring between - but not within - local labor markets (Braun, Kramer, et al. 2021, p.248). Braun, Kramer, et al. (2021, p.249) highlight that expellees moved in disproportionate numbers from regions with high inflows to regions with low inflows, a migration pattern that will be further examined in Section 6.1. Critically, Wyrwich (2020) challenges the approaches of both Schumann (2014) and Braun, Kramer, et al. (2021) by asserting that the main determinant of differing results lies not in the unit of observations but rather in the degree of war destruction in specific locations. Specifically, Wyrwich (2020) demonstrates that cities experienced more extensive destruction than rural areas, leading to divergent population dynamics. Generally, cities returned to their pre-war population growth trend with the inflow of expellees. However, looking at the treatment effect of the French migration barrier, the author shows that in regions with an above-median level of destruction - cities - in the French zone, there is a long-lasting negative effect, resulting in a persistent lower population density. Cities in the French zone failed to catch up with pre-war population growth trends. Overall, the findings suggest that agglomerations were more appealing to expellees, as it was particularly expellees that moved to cities in the 1950s (Wyrwich 2020, p.497-500).

On a political level, Chevalier et al. (2018) demonstrate that cities with higher expellee inflows exhibited greater voter turnout in local elections, with the expellee party garnering higher vote shares. Additionally, these high-inflow cities raised taxes on agricultural land, but not on housing and jobs, effectively shifting the tax burden onto farmers and business owners. Furthermore, the authors show that spending for social welfare increased in these cities (Chevalier et al. 2018, p.3-4). Falck, Heblich, and Link (2012) evaluate the 1953 Federal Expellee Law, enacted to ameliorate the dire economic circumstances faced by expellees. The authors find that the observed improvement of their situation cannot be attributed to the law, but rather to the general economic boom in West Germany (Falck, Heblich, and Link 2012, p.23). Notably, the authors discover that in 1950, expellees were 2 percentage points more likely to be unemployed compared to their local counterparts. Moreover, expellees were more likely to be employed in unskilled occupations and less likely to be self-employed compared to native West Germans, indicating a significant decline in their economic status relative to pre-war circumstances (Falck, Heblich, and Link 2012, p.12-13). Multiple studies confirm this economic downgrading. Bauer, Braun, and Kvasnicka (2013) find that expellees faced a significantly higher risk of unemployment compared to native Germans, and this displacement effect persisted across generations. In 1971, both first-generation and second-generation displaced persons reported lower average incomes than natives (Bauer, Braun, and Kvasnicka 2013, p.1000). Braun and Weber (2021) depict the high unemployment rates of high initial inflow regions, which gradually converged with low-inflow regions as expellees migrated within West Germany in the 1950s.

Analyzing the impact of expellees on the host society, Semrad (2015) shows that Sudeten Germans in Bavaria played a significant role in fostering educational development within the state. This resulted in positive spillover effects in terms of increased educational attainment and participation, as expellees demanded schools offering practical and business-oriented education (Semrad 2015, p.3). Braun and Mahmoud (2014) demonstrate that expellees actually led to a considerable reduction in employment rates among native West Germans. However, the employment of native individuals remained unaffected by expellee inflows as long as the expellee share did not exceed 15 percent. Peters (2022) shows that in the long term, expellee inflows increased local productivity and income per capita.

Pertinent to my study, Peters (2022) also discusses the impact of expellee inflows on structural change. The author shows a pronounced sectoral reallocation, with an increase in manufacturing employment, a decrease in agricultural employment, and no change in the service employment share. Peters (2022) suggests that expellee labor was primarily oriented towards the manufacturing sector. Interestingly, the settlement of refugees in less developed and more agricultural regions inadvertently led to industrialization and spurred rural development (Peters 2022, p.2359). Bauer, Braun, and Kvasnicka (2013) similarly show that displacement significantly accelerated transitions out of low-paid agriculture. In 1971, displaced males and females had a 68% and 78% lower probability, respectively, of working in agriculture than their native counterparts (Bauer, Braun, and Kvasnicka 2013, p.1000). Moreover, expellees were more likely to change sectors between 1950 and 1960. Notably, expellees who had been employed in agriculture before the war exhibited higher long-run income compared to natives in the same pre-war occupation, which can be attributed to expellees' faster transitions into other sectors (Bauer, Braun, and Kvasnicka 2013, p.1023). Braun and Dwenger (2017) show that due to limited capacity, agrarian regions had a significantly lower labor force participation rate among expellees. Supporting these findings, Braun and Kvasnicka (2014) demonstrate that a higher expellee share in 1950 was associated with an increase in non-agricultural employment in the same year. Additionally, more agrarian districts experienced faster sectoral change between 1939 and 1950, further corroborating the findings of Peters (2022) regarding rural industrialization. However, it is worth noting that the initial differences in the pace of sectoral change between high- and low-inflow districts may have leveled during the 1950s (Braun and Kvasnicka 2014, p.266-267).

4 Data

4.1 Digitization process

To evaluate the effect of the internal migration of expellees on the urban labor market and to visualize the migration flows, I digitized data from the Federal Statistical Office and the Statistical Yearbooks of German Cities and combined them with other data sources to create a novel dataset.

For the main explanatory variable, change in expellee share, I digitized the annual number of expellees (in 1000) between 1950 and 1960 for each of the 452 counties (*Landkreise*) and independent cities (*Kreisfreie Städte*) in West Germany from the statistical reports of Statistisches Bundesamt (1960a) to Statistisches Bundesamt (1961) (see Table 18 in the appendix for full list of statistical reports). To calculate the expellee share, I also digitized each of the 452 counties' and independent cities' annual population size (in 1000) from 1950 to 1960 from the same sources.

From the Statistical Yearbooks of German cities (Deutscher Städtetag 1950-Deutscher Städtetag 1960), I digitized the employment shares of agriculture, mining, iron and metal production, manufacturing, construction, trade, services, transport and public services in 1950, 1953, 1954, 1956, 1958, 1960 for 304 cities above 10,000 inhabitants to construct the dependent variables (see Table 18 in the appendix for full list of sources). Figure 3 depicts an exemplary table of employment shares in the Statistical Yearbook of German Cities in 1954.

To visualize the migration flows by occupation group by outflow state, I digitized the annual number of expellees migrating by occupation group from 1950-1955. The data was taken from Statistisches Bundesamt (1951b)-Statistisches Bundesamt (1957a) (see Table 18 in the appendix for full list of sources). Data is missing for the first six months of 1952 and for inflow states. In my study, I focused on seven key occupation groups: agriculture, industry and manufacturing, technical, trade and transport, care, administration, education and art.

I merge the digitized variables with several additional variables. The variables distance to inner German border, share of damaged housing after the war, the expellee share in 1946, the agricultural employment share in 1939 and the industry employment share in 1939 are taken from Braun and Dwenger (2017). The turnover per capita in 1935 is taken from Braun, Kramer, et al. (2021). The variable of the area of the counties and independent cities is taken from Max Planck Institute for Demographic Research and Chair for Geodesy and Geoinformatics, University of Rostock (2011).

Figure 3: Table of Employment Shares in Statistical Yearbook of German Cities 1954

2. Beschäftigte nach Wirtschaftsabteilungen am 30. 9. 1954

Gemeinde	Beschäftigte insg.	Davon entfielen in vH auf: Landwirtschaft usw.	Bergbau usw.	Eisen- u. Metallerzeugung usw.	Verarbeitende Gewerbe	Baugewerbe usw.	Handel usw.	Dienstleistungen	Verkehrswesen	Öffentlichen Dienst usw.
1	2	3	4	5	6	7	8	9	10	11
Gruppe A 1										
1 West-Berlin . °	816 050	1,1	1,7	19,2	16,4	10,5	14,1	9,3	6,0	21,8
2 Hamburg . . °	659 895	1,6	1,7	14,6	17,6	8,0	21,4	8,9	11,8	14,5
Gruppe A 2										
3 München . . .	408 719	1,5	1,5	15,8	16,6	9,2	18,0	11,7	8,7	16,9
4 Köln	270 766	0,7	1,5	18,6	19,6	10,5	18,5	9,4	9,5	11,7
5 Essen	267 533	0,9	22,5	16,0	11,6	12,6	15,0	6,8	5,4	9,2
6 Frankfurt/M. .	377 243	1,6	1,3	19,5	19,6	7,8	17,2	8,2	9,0	15,8
7 Düsseldorf . .	250 095	0,8	1,9	23,6	16,6	10,0	18,0	8,9	6,2	13,9
8 Dortmund . . .	247 285	1,3	21,1	24,0	7,7	11,0	13,4	7,1	5,9	8,5
9 Stuttgart	275 757	.	.	.	.	.	.	.	.	.
Gruppe A 3										
10 Hannover . . .	253 892	3,2	3,7	15,0	21,6	9,0	17,0	7,5	8,5	14,5
11 Bremen	181 525	1,4	2,3	18,6	16,2	7,4	21,4	8,0	10,9	13,7
12 Duisburg . . .	191 914	0,8	12,8	29,4	9,2	12,3	12,8	6,7	8,7	7,3
13 Nürnberg . . .	187 385	0,8	1,2	32,1	17,0	6,7	15,5	6,3	8,8	11,7
14 Wuppertal . .	163 212	0,7	1,4	23,3	32,0	6,7	13,5	6,3	6,7	9,3
15 Gelsenkirchen .	145 587	0,7	35,5	15,0	13,2	10,4	9,9	5,6	3,1	6,6

Source: Deutscher Städtetag (1954, p.268)

4.2 Variables

Expellee shares are calculated by dividing the absolute expellee number by the population number. Expellees are defined as all individuals who were living in 1939 in the former Eastern provinces according to the borders in 1937 (Statistisches Bundesamt 1957a, p.4). The expellee share data is reported for each county (*Landkreis*) and independent city (*Kreisfreie Stadt*). However, in the regression analysis, the unit of analysis is limited to cities with a population above 10,000, as the labor market data is reported at this level of observation. It is important to note that not every city with a population above 10,000 is classified as an independent city. Some cities above this population threshold are considered part of counties. To calculate the expellee share for every city above 10,000 inhabitants, a two-step approach was employed. For independent cities, the expellee share data was directly matched with the labor market data. However, for cities located in counties, a different method was used. Firstly, the county expellee share was calculated, and then this share was multiplied by the population of the specific city. Consequently, the expellee share of cities in counties represents an estimation and does not directly reflect the expellee shares in these cities. It is crucial to acknowledge the limitations of the estimation for cities in counties, while recognizing the accuracy of expellee share data for independent cities, as it was directly matched with the labor market data.

To calculate the dependent variables, I calculate the difference between 1950 and 1960 per occupation group c for each city i respectively and thereby create the dependent variable of employment change, as presented in equation 1. The occupation groups are agriculture, iron and metal production, manufacturing, construction, trade, services, transport and public services. See Table 19 in the appendix for the definitions of each occupation group.

$$\text{empl\_change}_{ic} = \text{empl\_change}_{ic60} - \text{empl\_change}_{ic50} \tag{1}$$

The dependent variable used in the regression analyses is the employment share change. However, it is important to acknowledge that the occupation groups used to visualize the outmigration of expellees from 1950-1955 in Section 6.1.2 have different definitions. These occupation groups were not sourced from the Statistical Yearbook of German cities, but rather from reports published by the Federal Statistical Office. In these reports, the occupation groups of agriculture, industry and manufacturing, technical, trade and transport, care, administration, education and art are reported (see Table 20 in the appendix for definitions). Consequently, there are variations in the composition of these groups compared to the definitions found in the Statistical Yearbook of German cities. For example, iron and metal production, manufacturing, and construction are reported together as a single group (Industry and manufacturing) by the Federal Statistical Office, and trade and transport are not reported separately. Additionally, services are defined as care, public services are classified as administration, and education and art form an extra group. It is important to note that while the statistical reports provide comprehensive data for a total of 32 affiliated occupations, this detailed information is not available on an annual basis. Consequently, I relied on the aggregate data for the seven major occupation groups to carry out my analysis.

From the dataset of Braun and Dwenger (2017), I use the distance to the inner German border, which is measured in kilometers. The inner German border might have impaired employment growth as regions at the inner-German border experienced a disproportionate loss in market access after the Second World War (Redding and Sturm 2008, p.1767). Furthermore, I add the damage share after the war, which measures the share of dwellings built until 1945 that were damaged in the war (Braun and Dwenger 2017, p.28). Braun and Dwenger (2017, p.28) explain that this measure reflects the condition of residential housing that survived the war and could accommodate residents in 1950. It serves as an important indicator of the initial allocation of expellees, influencing subsequent migration flows by defining the origin locations of the expellees as they were mostly allocated to locations with available housing. Also, I add the expellee share in 1946, the agricultural employment share in 1939 and the industry employment share in 1939. It should be noted that the data was available at the county-level, so for cities located in rural counties (*Landkreise*), these figures are derived from the respective rural county data and do not directly represent the expellee shares in the cities. However, for independent cities, these figures directly correspond to the expellee shares, as they are available in the data. Similarly, the turnover per capita in 1935 is added from Braun, Kramer, et al. (2021), which is pre-war data taken from turnover tax statistics. The area of each county and independent city from Max Planck Institute for Demographic Research and Chair for Geodesy and Geoinformatics, University of Rostock (2011) is included to control for the size of the territories in the geographically-weighted regression. Hence, I define three groups of control variables: city controls (population size and distance from inner German border), post-war controls (damage share, expellee share in 1946) and pre-war controls (agricultural employment in 1939, industry employment in 1939, turnover per capita in 1935).

5 Methodology

To evaluate the role of expellee inflows on employment structure changes, I utilize various empirical methods. First, I provide a visualization of the spatial patterns of expellee migration and labor market developments in West Germany in the 1950s. Then, I compute a multiple linear regression for the baseline estimation. Lastly, I conduct geographically-weighted regression (GWR) to evaluate the effect of expellee migration on urban labor markets. This approach captures the spatial variation in the expellee flows and accounts for spatial dependence in the data. The combination of various empirical approaches allows for comprehensive exploration of the relationship between expellee share changes and employment structure changes within a spatial context.

It is important to note that I will treat expellee inflows as a proximate instead of a fundamental determinant of employment changes following Squicciarni and Voigtländer (2015). Squicciarni and Voigtländer (2015) differentiate between proximate and fundamental drivers and emphasize that proximate determinants can coexist with other proximate determinants, while a fundamental determinants cannot be complementary to other drivers (Squicciarni and Voigtländer 2015, p.1876). Since the migration of expellees was primarily motivated by employment opportunities, it is important to acknowledge that other drivers may have also influenced changes in the employment structure. Factors such as non-expellee migration, pre-war employment structures and destruction levels could have played a role in shaping the employment structure. Moreover, it is worth considering the possibility of reverse causality, where changes in employment shares may have influenced expellee inflows, rather than the other way around. For instance, if employment shares in the trade sector increased, expellees might have perceived it as a signal of rising job opportunities and subsequently migrated to cities exhibiting such growth. As a result, establishing a causal interpretation becomes challenging, prompting me to treat expellee migration as a proximate determinant in my study. The objective is to determine whether expellee migration, among other proximate determinants, significantly contributed to changes in the employment structure or not.

5.1 Descriptive spatial analysis

First, I use GIS to visualize various aspects of the expellee migration flow within West Germany in the 1950s. Using my novel dataset, I provide descriptive spatial evidence for the distribution of the expellee stocks and flows, as well as migration patterns by occupation group and rural-urban migration.

Furthermore, I visualize the employment share changes of the agriculture, iron and metal production, manufacturing and services sectors. Results are shown in Section 6.1 and 6.2.

5.2 Baseline estimation

Second, I conduct an ordinary-least squares (OLS) regression for each industry sector as a baseline estimation. The regression equation is specified as follows:

$$\begin{aligned} \text{empl\_change}_i = {} & \beta_0 + \beta_1 \text{exp\_change}_i + \beta_2 \text{pop}_i + \beta_3 \text{dist\_bord}_i + \beta_4 \text{damage}_i \\ & + \beta_5 \text{exp\_1946}_i + \beta_6 \text{agr\_1939}_i + \beta_7 \text{ind\_1939}_i + \beta_8 \text{turnover\_1935}_i + e_i \end{aligned} \tag{2}$$

where empl_change_i is the dependent variable employment share change, calculated as the difference of the employment share in 1950 and 1960 for each city i (see Section 4.2). exp_change_i denotes the difference of the expellee shares between 1950 and 1960 for each city. pop_i is the population divided by 1000 for each city. To account for the impact of proximity to the inner German border, dist_bord_i is included as a control variable. Both the population and the distance control are classified as city-level controls. The variable damage_i captures the share of houses which were built until 1945 that were damaged during the war. exp_1946_i represents the share of expellees in the cities in 1946. Both the damage and the expellee share in 1946 are post-war controls. Similar procedures apply to agr_1939_i, ind_1939_i, and turnover_1935_i, which are the pre-war controls. agr_1939_i is the share of agriculture employment in 1939, ind_1939_i represents the share of industry employment in 1939, and turnover_1935_i represents the turnover per capita in 1935.

As previously mentioned, I choose the agriculture, manufacturing and service sectors as the main occupation groups to account for structural changes of employment composition of the three major sectors in the economy. Furthermore, the baseline results reveal a strong association of expellee inflows and iron and metal production employment. Therefore, the detailed results for the iron and metal production industry are presented as well.

The regression is conducted using Stata 17.0. The number of observations differ by industry and is reported for each industry respectively. Standard errors are robust and clustered at the city-level.

5.3 Geographically-weighted regression

The geographically weighted regression (GWR) model provides a more comprehensive approach compared to the traditional OLS regression model in capturing spatial variability in the relationships between variables. Unlike OLS, which assumes fixed global estimates of regression coefficients for the entire study areas, GWR acknowledges that these relationships may vary across space. This is particularly important for uncovering interesting geographical patterns that might be obscured by the assumption of global estimates, thereby invalidating simple trend-fitting exercises (Brunsdon, Fotheringham, and Charlton 1996, p.282).

The OLS model described in the previous section does not consider the spatial variation in employment share changes or expellee share changes, as both variables exhibit significant spatial variability. To address this limitation, I employ GWR to account for the spatial variation.

Introduced by Brunsdon, Fotheringham, and Charlton (1996), GWR allows for estimating and mapping actual parameters at each location in space, as opposed to fitting a trend surface to the data (Brunsdon, Fotheringham, and Charlton 1996, p.282). This is crucial because spatial data collected for regions or spatial points often exhibit dependence, meaning that nearby observations tend to have similar values, indicating positive spatial dependence. Conventional regression models, such as OLS, assume independence among data points and do not account for spatial dependence, which is an incorrect assumption for regional data (LeSage and Pace 2010, p.355-356). Unlike OLS regression, GWR allows for the estimation of local variations in the relationship between the dependent variable and covariates across the study area. With each city i having its own set of regression coefficients, GWR captures spatially varying relationships (Wheeler and Páez 2010, p.461-462). The GWR model at each calibration location i = (1, ..., n) can be expressed as:

$$\mathrm{y}_i = \beta_{i0} + \sum_{k=1}^{p-1} \beta_{ik} x_{ik} + e_i \tag{3}$$

where y_i represents the dependent variable value at location i, x_{ik} denotes the value of the kth covariate at location i, β_{i0} is the intercept, β_{ik} represents the regression coefficient for the kth covariate, p is the number of regression terms, and e_i is the random error at location i (Wheeler and Páez, 2010, p.462-463).

It is advantageous to express the GWR model in matrix notation:

$$\mathrm{y}_i = X_i \beta_i + e_i \tag{4}$$

where β_i is a column vector of regression coefficients and X_i is a row vector of explanatory variables at location i (Wheeler and Páez 2010, p.462). The vector of estimated regression coefficients at location i is:

$$\hat{\beta}_i = \left(X^T W_i X\right)^{-1} X^T W_i Y \tag{5}$$

Here, Y is the n-by-1 vector of dependent variables, X is the matrix of explanatory variables, including a leading column of ones for the intercept, W_i is the n-by-n diagonal weights matrix calculated for each calibration location i, and $\hat{\beta}_i$ is the vector of p local regression coefficients at location i, representing $p-1$ explanatory variables and an intercept. Given this equation, GWR may be viewed as a locally weighted least squares regression model where weights associate the model calibration location i with all data points, including the calibration location itself. The weights matrix must be calculated at each location before the local regression coefficients can be estimated with the equation (Wheeler and Páez 2010, p.462).

In GWR, the local weights matrix, W_i, represents the weights assigned to the relationships between the dependent variable and covariates at each location i. It is calculated using a kernel that assigns higher weights to locations closer in space to the calibration location and lower weights to locations farther away. This weighting scheme is based on the assumption of spatial autocorrelation, which implies that nearby locations are more likely to exhibit similar values. As a result, the use of such weights allows for the detection of non-stationary patterns in estimated coefficients (Wheeler and Páez 2010, p.462-463).

The kernel function in GWR takes the distance between two locations as input and is characterized by a bandwidth parameter, denoted as γ, which determines the spatial range of the kernel. The function returns a weight that is inversely related to the distance between two locations. Various kernel functions have been proposed for GWR; but a commonly used one is the Gaussian kernel function, which I use as well:

$$W_{ij} = \exp\left(-\frac{1}{2}\left(\frac{d_{ij}}{\gamma}\right)^2\right) \tag{6}$$

In this equation, W_{ij} represents the weight for observation j relative to observation i, d_{ij}

is the distance between the two locations, and γ is the bandwidth parameter that governs the extent and decay of spatial correlations. Hence, the weights decrease monotonically with distance (Wheeler and Páez 2010, p.462-464).

To estimate the kernel bandwidth γ, I employ the corrected AIC (AICc) approach, which minimizes the estimation error of the response variable rather than relying on its prediction. This approach finds a compromise between model fit and complexity by penalizing the criterion based on the effective number of parameters in the model. The equation for the corrected AIC for GWR can be found in the appendix. The estimation involves evaluation of the AIC as the objective function over a range of values for the kernel bandwidth parameter, aiming to minimize the AIC (Wheeler and Páez 2010, p.465-466).

In my GIS analysis, I employ the 'Number of Neighbors' as the neighborhood type parameter to determine the size of the neighborhood. This allows for varying neighborhood sizes, accommodating smaller neighborhoods in dense areas (i.e., Ruhr area) and larger neighborhoods in sparse areas (i.e., Bayern) (ESRI 2023).

Regarding the neighborhood selection method, I choose the 'Golden Search' option. This method determines the optimal number of neighbors by utilizing the golden section search technique. It iteratively tests the AIC at various distances within a range defined by the maximum and minimum distances. In cases where the number of features is fewer than 1000, as is the case in my study, the maximum distance is computed as the distance at which each feature has half the number of features ($n/2$) as neighbors. The minimum distance, on the other hand, is determined as the distance at which each feature has at least 5 percent of the total number of features (5 percent of n) as neighbors. In my study, the specific value of n varies depending on the sector being analyzed: for agriculture, there are 134 features, iron and metal production includes 92 features, manufacturing 90 features and services 92 features. By employing the golden search method, the number of neighbors that minimizes the AIC values can be determined, ultimately identifying the appropriate neighborhood size for each sector of interest (ESRI 2023).

In conclusion, the GWR equation in my study follows Wheeler and Páez (2010, p.461-462) and is defined for each city i as follows:

$$\begin{aligned}\text{empl\_change}_i = {} & \beta_{i0} + \beta_{i1}\text{exp\_change}_i + \beta_{i2}\text{area}_i + \beta_{i3}\text{dist\_bord}_i + \beta_{i4}\text{damage}_i + \beta_{i5}\text{agr\_1939}_i \\ & + \beta_{i6}\text{ind\_1939}_i + \beta_{i7}\text{pop\_1939}_i + \beta_{i8}\text{exp\_1946}_i + e_i\end{aligned} \tag{7}$$

where empl_change_i represents the employment share change at city i, and β_{ik} are the regression coefficients specific to each city i for k covariates. β_{i0} is the intercept term at city i. exp_change_i is the expellee share change between 1950 and 1960. area_i is the area of city i

to control for its size. $dist\_bord_i$, $damage_i$ and agr_1939_i are defined as in the OLS regression and represent the distance to the inner German border, the damage share in 1945 and the agricultural employment share in 1939 for each city i. pop_1939_i is a covariate which controls for the population size in 1939. exp_1946_i controls for the expellee share in 1946 in each city i. The random error term at each city is denoted as e_i.

6 Results

6.1 Migration of expellees in the 1950s

In the following, the results of the descriptive spatial analysis for the visualization of the migration of expellees in the 1950s are presented.

The 1950s constituted an era of reconstruction and substantial economic growth in West Germany. Simultaneously, expellees were free to migrate within the country after 1949. Figure 4 illustrates the expellee shares in the West German counties in 1950 and 1960. In 1950, there is a high concentration of expellees in the eastern counties, as the left-hand panel clearly indicates. This distribution can be better comprehended by considering two key factors that influenced allocation. First, the states which were closer to the former German territories received a higher inflow of expellees due to their geographic proximity (Bethlehem 1987, p.160). Second, housing availability was a crucial determinant for the initial settlement of expellees, particularly in areas heavily impacted by bombardment and destruction during the Second World War. The situation of the housing market was described as "catastrophic" (Stahlberg 1957, p.9). The relatively heavy destruction of urban areas resulted in higher housing availability in rural areas, which led to the allocation of expellees in the countryside (Stahlberg 1957, p.10). Since housing availability and geographic proximity were the two deciding factors for expellee allocation, this resulted in a concentration of expellees in the predominantly agrarian states of Schleswig-Holstein, Niedersachsen and Bayern. In 1950, the percentage of expellees was 34.5% in Schleswig-Holstein, 26.9% in Niedersachsen and 21.1% in Bayern (Statistisches Bundesamt 1951a, p.6) (see Table 1).

Table 1: Expellee shares in West German states 1950

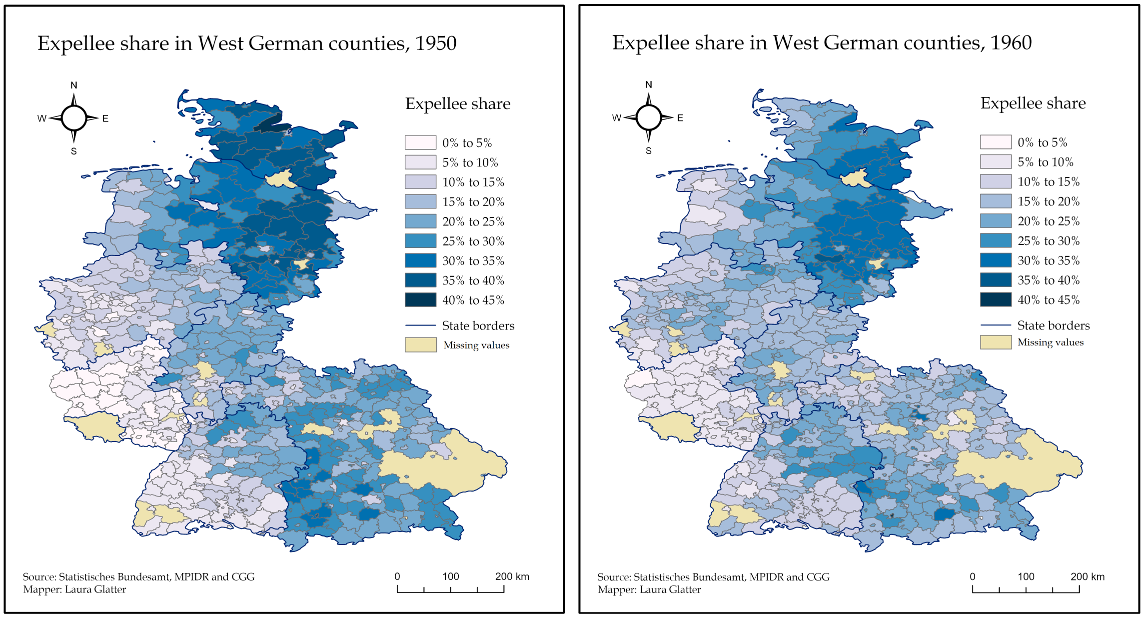
State	Population	Expellees (absolute)	Expellee share
Schleswig-Holstein	2,593,600	894,855	34.5%
Niedersachsen	6,795,100	1,830,110	26.9%
Bayern	9,118,600	1,926,003	21.1%
Württemberg-Baden	3,884,500	737,179	19.0%
Hessen	4,303,900	685,243	15.9%
Nordrhein-Westfalen	13,147,100	1,289,827	9.8%
Württemberg-Hohenzollern	1,241,000	119,464	9.6%
Baden	1,335,500	104,948	7.9%
Bremen	558,100	42,740	7.7%
Hamburg	1,604,600	107,694	6.7%
Rheinland-Pfalz	2,993,700	137,080	4.6%

Source: Statistisches Bundesamt 1951a, p.6

Schleswig-Holstein, the most heavily affected state, witnessed a remarkable population increase of 63% from 1939 to 1950 (Edding 1955, p.18). Edding (1955) provides a vivid description of the situation in Schleswig-Holstein as follows: "Forced confinement in apartments, barns, halls, barracks, public welfare through money and vouchers, private help with beds, clothes and some household goods, casual labor, collecting firewood, mushrooms and berries, some black market trade, a lot of hunger, a lot of waiting and a lot of mental hardship (...)" (Edding 1955, p.19). In Niedersachsen, Kollai (1959, p.27-28) describes the dire housing situation in the northern regions bordering Hamburg and Schleswig-Holstein, where many expellees initially had to be accommodated in hospitals. Many also were allocated to refugee camps and emergency shelters. Bayern experienced a significant influx of expellees primarily from the nearby Sudetenland, with 53% of expellees in the state originating from that region (Spiethoff 1955, p.26). Although data for the eastern counties of Bavaria near the Sudetenland is missing in Figure 4, Spiethoff (1955, p.22) indicates a marked change in population structure and significant increases in population density resulting from the inflow of expellees.

Figure 4: Expellee shares in West German counties

(a) Expellee share 1950 (b) Expellee share 1960



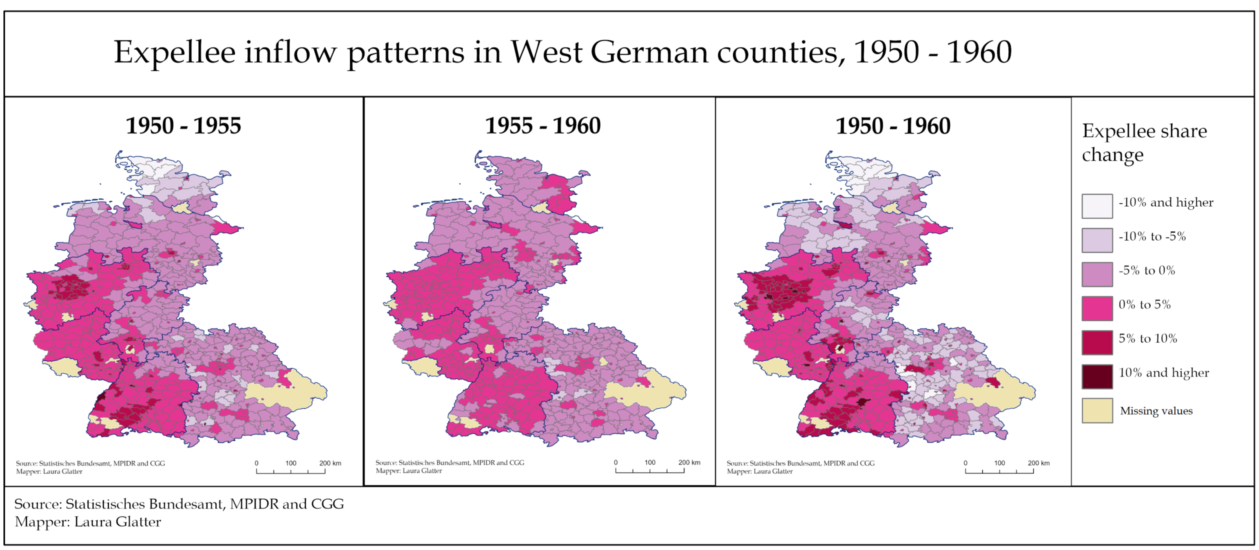
While the eastern states (Schleswig-Holstein, Niedersachsen and Bayern) experienced an inflow of above 20%, the western states in comparison experienced only a small inflow. For instance, only 4.6% of expellees resided in Rheinland-Pfalz by 1950 (Statistisches Bundesamt 1951a, p.6). However, the relatively low expellee share in Rheinland-Pfalz, Baden and Württemberg-Hohenzollern (which were later merged with Württemberg-Baden to the state of Baden-Württemberg in 1952) can be attributed to the fact that these regions were part of the French occupation zone. As previously mentioned, France did not participate at the Potsdam Conference in 1945 and thus it did not consider itself obligated to take in any expellees. Consequently, a prohibition on expellee settlement was enforced in these regions until 1950 (Müller 1962, p.16). This explains the expellees shares ranging from 0% to 5% depicted in the left-hand panel of Figure 4 for these areas. Similarly, counties in Nordrhein-Westfalen experienced a relatively limited influx of expellees, despite being the second-largest state in West Germany. Apart from being geographically distant from the former East German provinces, the counties in this state had endured significant destruction, prompting the British occupation government to designate them as 'restricted areas' and impose a prohibition on immigration. This prohibition remained in effect until August 1945, preventing expellees from settling in Nordrhein-Westfalen and contributing to lower expellee shares (Bethlehem 1987, p160). Although the inflow of expellees in Hessen was not as overwhelming as in the high-inflow states, a constant stream of expellees did arrive, leading to a population increase of 24% between 1939 and 1950 (Albrecht 1954, p.18). Around 54% of the expellees were allocated to the predominantly agricultural northern region of the state, which lacked industrial resources (Albrecht 1954, p.10).

By 1960, the distribution of expellees into the West German counties had become more dispersed, as indicated in the right-hand panel of Figure 4. Notably, there was a westward shift in the distribution, with industrial regions in Nordrhein-Westfalen, Hessen and Baden-Württemberg showing a considerably higher concentration of expellees by the end of the decade. However, the split of the state of Baden-Württemberg into the American and the French zones, as well as the settlement prohibition enforced by the French until the late 1940s, resulted in a smaller expellee share in the southern part of the state, a trend that persisted until 1960. While almost no expellees settled there in 1950, by 1960 the expellee shares had risen to between 15%-20% in some counties. However, compared to the northern region of Baden-Württemberg, where the shares amounted to as high as 30% in 1960, the disparity remained evident.

6.1.1 Inflow and outflow patterns

Figure 5 shows the results for the inflow patterns to analyze relocation flow patterns of expellees.

Figure 5: Inflow patterns of expellees to West German counties, 1950 - 1960



Clearly, the inflows concentrated in the western regions, with industrial regions of Hessen, Nordrhein-Westfalen and Baden-Württemberg experiencing increases of expellee shares of 10% and higher between 1950 and 1960. Interestingly, the substantial increases primarily occurred during the first half of the 1950s. The left-hand panel of Figure 5 illustrates that increases between 5%-10% took place in high-inflow regions from 1950 to 1955, while the center panel indicates that the increases between 1955 and 1960 remained below 5%.

These patterns can largely be explained by employment opportunities in inflow regions. As industrial areas underwent gradual reconstruction, employment capacities expanded, new housing was constructed, and expellees, who faced limited job prospects in rural areas, began to migrate once again. In this second phase of expellee migration, Nordrhein-Westfalen emerged as the primary destination for both voluntary relocation and government-led relocation transfers (Stahlberg 1957, p.10-11). Between 1950 and 1953, the state experienced a population increase of 1.04 million people, with approximately 494,556 being expellees (Stahlberg 1957, p.33-34). Expellees predominantly settled in the Ruhr industrial area, which offered increasing employment opportunities, serving as a strong economic pull factor. Among the expellees relocated through government-organized transfers, 76.5% were settled in this area (Stahlberg 1957, p.29). Stahlberg (1957, p.17) writes that the economic capacity expansion in the state of Nordrhein-Westfalen proved highly suitable for the economic integration of a significant population influx, particularly in the years following the currency reform, as the increase in production facilitated a substantial expansion of employment opportunities. Thus, the concentration of expellee shares in the Ruhr industrial area during the early years of the decade, as opposed to the later half, can be attributed to enhanced employment opportunities following the currency reform in 1948.

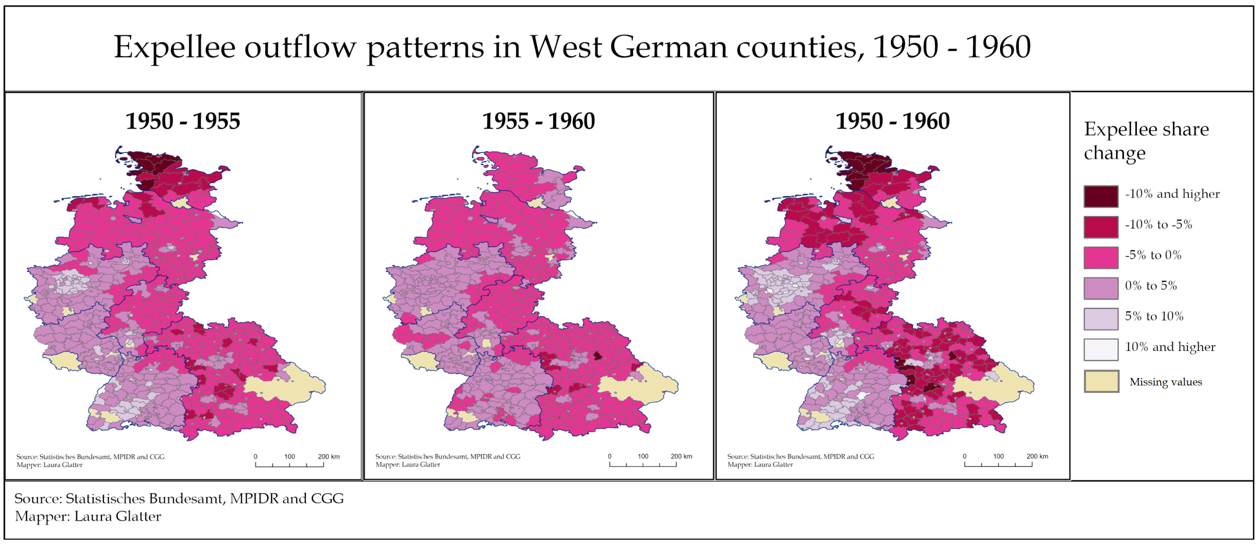
Hessen experienced a similar concentration of inflows in its industrial areas. While the initial inflow of expellees was primarily concentrated in the northern region, during the 1950s, expellees increasingly relocated to the southern region, where major cities such as Frankfurt and Wiesbaden are located. Similar to Nordrhein-Westfalen, this relocation trend was largely influenced by rising employment opportunities in citites and industrial areas (Albrecht 1954, p.10-19).

As the French occupation government lifted the settlement prohibition for expellees in the French zone in 1949, the expellee population in Rheinland-Pfalz tripled. In the early 1950s the increase was mainly driven by government-organized transfers, resulting in the relocation of 111,340 expellees to the state. As the state was gradually more included in the economic upswing of West Germany, heavy economic burdens were alleviated in the French zone and large construction projects were undertaken by the Allies. Consequently, voluntary relocations to Rheinland-Pfalz also increased in the early 1950s (Wagner 1956, p.23-24). Figure 5 demonstrates inflow rates of up to 5% in almost every county in Rheinland-Pfalz from 1950 to 1955.

In Baden-Württemberg, the southern region experienced a notable increase in expellee shares. This can be attributed to the lifting of the settlement prohibition by the French occupation government. However, in the late 1950s, some counties in the southern part began recording a decline in expellee shares, as the northern part offered greater employment opportunities in the industrial sector (Müller 1962, p.17).

Correspondingly, the states that initially witnessed a massive inflow of expellees after the war experienced significant outflows during the 1950s. Figure 6 shows outflow patterns of expellees to West German counties from 1950 to 1960.

Figure 6: Outflow patterns of expellees to West German counties, 1950 - 1960



Schleswig-Holstein saw the highest outflows, particularly during the first half of the decade. Most northern counties of the state experienced an outflow of more than 10% during that time. From 1950 to 1953, around 260,000 expellees left the state. As the heavy influx of expellees after the war significantly impacted the economic well-being of the local population, native residents also began to emigrate from Schleswig-Holstein (Edding 1955, p.36). In the second half of the decade, outflows continued but at a slower rate, ranging from -5% and 0% in most counties, with some even experiencing an increase in the expellee share.

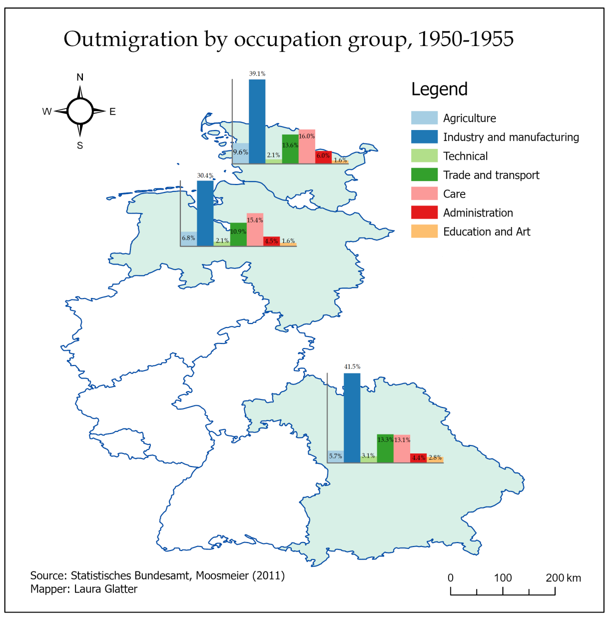
In Niedersachsen, also a high inflow state, most counties recorded a decline in expellee shares from 1950 to 1960, particularly in the first half of the decade. The significant outflow can be attributed to government-organized transfers from 1950 to 1955, aimed at relieving states with high expellee shares, as well as the increasing voluntary relocation of expellees in search of employment. The Institute for Regional Planning highlighted in a report that Niedersachsen's economic capacity could sustain a population of approximately 5.95 million. However, in 1954, the population stood at around 6.59 million inhabitants, prompting the Niedersachsen government to advocate strongly for the further implementation of the relocation program (Kollai 1959, p.39).

Bayern witnessed a considerable outflow of expellees from rural areas throughout the 1950s, while larger cities such as München and Nürnberg experienced an increase in expellee shares. This pattern of outflows from rural areas and inflow to urban areas continued throughout the decade. It was largely shaped by the rising employment opportunities in cities (Spiethoff 1955, p.33). Furthermore, the Bavarian state was relieved of the disproportionate influx of expellees through government-organized transfers, which relocated approximately 163,000 expellees between 1950 and 1954. An additional 111,000 expellees chose to relocate voluntarily during this period (Spiethoff 1955, p.40-41).

6.1.2 Migration by occupation groups

To gain deeper insights into the migration patterns of specific occupation groups, I visualize the migration flows by occupation group for the three outflow states.

Figure 7: Outmigration by occupation group, 1950-1955



Sources: Statistisches Bundesamt, Moosmeier (2011)

Figure 7 illustrates the expellee migration patterns categorized by occupation group between 1950 and 1955[4]. The shares presented in the figure represent the proportion of outmigrating expellees from a particular occupation group relative to the total number of employed expellees who migrated annually. The data reveals that a significant portion of the outmigrating expellees were employed in the industry and manufacturing sector. In Bayern, for

[4]Schleswig-Holstein percentages: (1) 9.6%, (2) 39.1%, (3) 2.1%, (4) 13.6%, (5) 16.0%, (6) 6.0%, (7) 1.6%. Niedersachsen: (1) 6.8%, (2) 30.4%, (3) 2.1%, (4) 10.9%, (5) 15.4%, (6) 4.5%, (7) 1.6%. Bayern: (1) 5.7%, (2) 41.5%, (3) 3.1%, (4) 13.3%, (5) 13.1%, (6) 4.4%, (7) 2.8%; not shown percentages are people who did not specify their occupation.

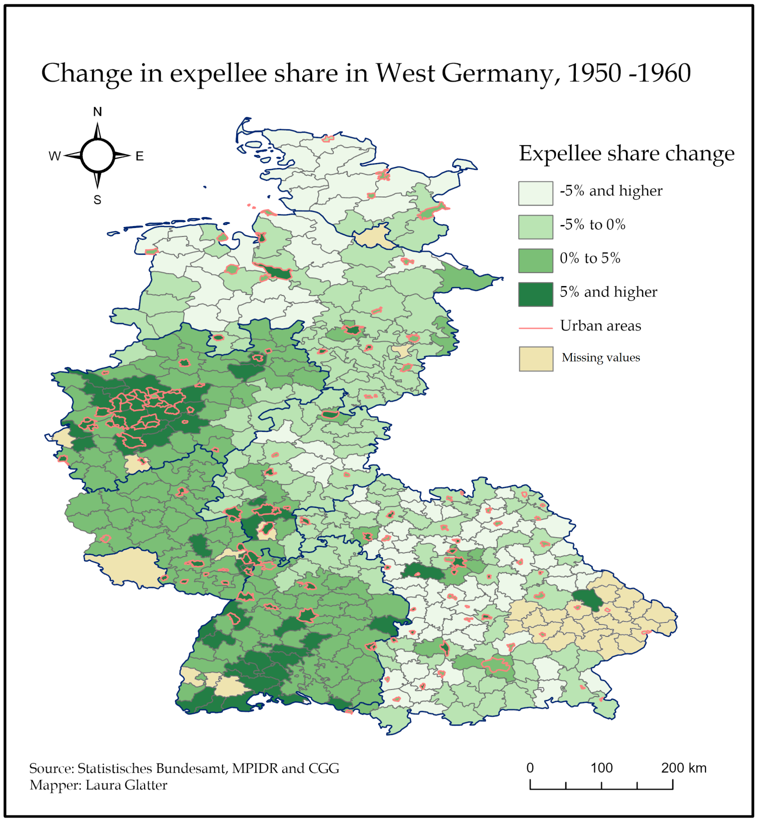
instance, industry and manufacturing workers accounted for 41.6% of all outmigrating employed expellees, whereas the agricultural sector comprised only 5.7%, and the trade and transport as well as care sectors constituted approximately 13.3% each. Similar patterns are observed in Schleswig-Holstein and Niedersachsen.

The prominent presence of industrial and manufacturing workers among the resettling expellees reflects the primary objective of the resettlement efforts, namely to effectively integrate expellees into employment opportunities in their new destinations. This objective, however, was not without controversy. Receiving states favored the resettlement of primarily employable individuals, while outflow states aimed to resettle both employable people but also individuals who were unable to work or had work-related limitations and required state support. The goal for the outflow states was to avoid becoming a "home for the elderly" or a "poor house" (Bethlehem 1987, p.163). Thus, while government-led resettlement was less selective and encompassed a broader range of the population, it was still voluntary in nature, potentially leading to a higher proportion of industrial workers opting for the resettlement program. However, the main reason for the statistics recording a higher proportion of industrial workers is the fact that voluntary migration (not government-organized), which outpaced government-led resettlement, attracted mainly young individuals seeking better job opportunities (Edding 1955, p.43-44). Consequently, the overall resettlement process did not effectively correct the population structure by resettling unproductive individuals, particularly those who were incapacitated or had limited work capabilities. Contrary to the intention of achieving social population equalization, it becomes evident that the resettlement process primarily involved resettling individuals capable of working. From the perspective of the receiving states, this migration pattern indicates that resettlement predominantly provided labor to the industrial centers. Surveys conducted in Nordrhein-Westfalen on the employment situation among resettlers illustrate the extent to which the existing labor demand was fulfilled. A representative survey conducted in 1952 showed a substantial increase in employed resettlers and a significant decline in unemployment. Thus, the goal of economic integration through resettlement was largely accomplished, particularly as resettled individuals were concentrated in industrial areas (Bethlehem 1987, p.163-167). These findings shed light on why industrial and manufacturing workers constituted the largest group among the resettling expellees.

6.1.3 Rural-urban migration

One of the central phenomenons of the expellee migration within West Germany in the 1950s was the migration from rural to urban areas. To illustrate this, I highlighted urban areas in the map of expellee share changes in Figure 8.

Figure 8: Expellee share growth in urban areas



While not all areas with an expellee change higher than 5% were cities, Figure 8 demonstrates a significant overlap between high inflow areas and cities. Particularly in Nordrhein-Westfalen, numerous cities experienced high inflows. Initially, expellees were primarily allocated to rural areas due to greater housing availability and significant war damages in cities. However, during the early 1950s, this trend rapidly shifted. In 1946, only 23.2% of expellees resided in cities, whereas by 1953, the percentage had risen to 43.3% in urban areas of Nordrhein-Westfalen (Stahlberg 1957, p.14). Furthermore, government-organized transfers actively promoted settlement in urban areas, whereas relocations to less economically active regions predominantly aimed at family reunions or the resettlement of non-employable individuals, such as pensioners (Stahlberg 1957, p.30).

In Hessen, the migration flows to the urban areas of Frankfurt, Wiesbaden and Kassel were particularly pronounced. Surrounding counties of these major cities also experienced inflows. The majority of the urban inflows occured between 1951 and 1952, resulting in a decline of expellees in rural areas from 83% to 77% within one year. The capacity of cities to accommodate expellees increased as new housing and production sites were constructed (Albrecht 1954, p.20).

In Rheinland-Pfalz, the first government-organized transfers directed expellees to rural districts. However, between 1950 and 1953, expellees mostly migrated to cities, especially Kaiserslautern, where Allies organized housing construction campaigns. Thus, the availability of housing coupled with economic activity emerged as the driving force of expellee migration flows to Rheinland-Pfalz (Wagner 1956, p.27-28).

Similarly, this driving force shaped the migration of expellees in Baden-Württemberg. In the northern part of the state, the rural-urban migration pattern was particularly evident as cities like Mannheim, Karlsruhe and Pforzheim emerged as highly attractive industrial centers. Nevertheless, many rural districts in the southern part experienced high inflows due to the lifting of the settlement prohibition in 1949 (Müller 1962, p.18-19).

In Schleswig-Holstein, Niedersachsen and Bayern, all rural counties experienced a large outflow of expellees particularly from 1950 to 1953 (Edding 1955, p.37). However, some cities witnessed slight inflows over the full sample period of 1950 and 1960. In 1952, the Bavarian Secretary of State for the Affairs of the Expellees cautioned about the potential strain on the capacity of cities and their supply infrastructure. He stated: "There is a danger that the capacity of the cities, especially their entire supply facilities, will be exhausted at a time when a considerable number of the evacuees and expellees who have been displaced to the countryside are still pushing for a job in the city" (Spiethoff 1955, p.34-35). The absorption capacities of cities was therefore a crucial determinant for the successful integration of expellees.

To provide an overview of rural-urban migration in all states, I calculated the average changes of expellee shares for rural and urban areas. The results are presented in Table 2.

Table 2: Expellee share changes in rural and urban areas, 1950 - 1960

	(1) Full sample mean	(2) Rural areas mean	(3) Urban areas mean
Expellee share change	0.88	-2.14	6.13
Outflow states			
Expellee share change	-2.80	-4.98	3.89
Inflow states			
Expellee share change	4.21	1.63	8.25
N	452	324	128

Source: Statistisches Bundesamt (1952c)-Statistisches Bundesamt (1961)

While overall the share of expellees increased only modestly around 0.88% in all West German counties, a stark contrast emerged when examining rural and urban areas separately. Rural areas exhibited a substantial outflow of expellees, whereas urban areas, on average, witnessed an inflow of 6.13% from 1950 to 1960. Moreover, I examined the distinct situation in both the outflow states (Schleswig-Holstein, Niedersachsen and Bayern) and inflow states (Nordrhein-Westfalen, Rheinland-Pfalz, Hessen, Baden-Württemberg, Hamburg and Bremen). In outflow states, counties experienced an average decline in expellee shares of approximately -2.8%. This decline was predominantly observed in rural areas, whereas urban areas demonstrated an increase in expellees. Conversely, in inflow states, both rural and urban areas experienced an increase in expellees, although urban areas recorded a notably higher influx, averaging around 8.25%.

6.2 Labor market developments in the 1950s

The previous section has shown the substantial expellee inflow to urban areas. Using the newly digitized data from the Statistical Yearbooks of German cities, I present the developments of the labor markets in German cities above 10,000 inhabitants in this section.

Table 3 presents the employment shares of the different occupation groups both in 1950 and 1960.

Table 3: Employment shares 1950 and 1960

	(1) Full sample mean	(2) Outflow states mean	(3) Inflow states mean
1950			
Agriculture	4.5	6.8	3.6
Manufacturing	19.9	20.2	19.7
Mining	5.9	2.2	8.3
Iron	14.2	12.3	15.4
Construction	8.2	8.1	8.2
Trade	14.9	15.4	14.5
Services	8.2	9.2	7.6
Transport	7.2	8.0	6.7
1960			
Agriculture	2.8	4.9	1.8
Manufacturing	20.8	20.6	20.9
Mining	6.8	3.8	8.1
Iron	23.1	19.1	24.9
Construction	10.2	11.4	9.7
Trade	12.4	13.3	12.0
Services	6.3	6.6	6.2
Transport	5.8	7.0	5.3
N	304	97	207

A substantial decline in agricultural employment was recorded over the decade, both for outflow states and inflow states. Traditionally, the outflow states of Schleswig-Holstein, Niedersachen and Bayern were more agrarian (Statistisches Bundesamt 1955d, p.28). Manufacturing employment increased, particularly in inflow states. Perhaps the most marked increase in employment shares was in the iron and metal production industry, which increased from 14.2% to 23.1% in the full sample. Overall, the direction of the change is similar in outflow and inflow states, however, the size of the change differs in the samples. Subsequently, the regional growth rates for the sectors of agriculture, iron and metal production, manufacturing and services will be presented.

Figure 9 presents the regional growth rates of employment shares in agriculture. Most cities recorded a decline in agricultural employment shares. However, several cities in outflow states, mainly in Niedersachsen and Bayern, recorded an increase in agricultural employment. A few cities in Baden-Württemberg, Hessen and Nordrhein-Westfalen also recorded positive employment share changes.

Figure 9: Agriculture employment growth

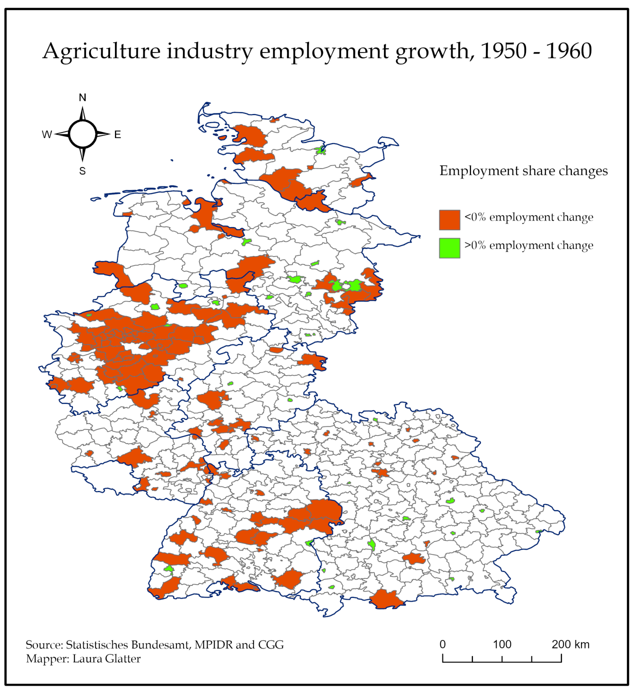
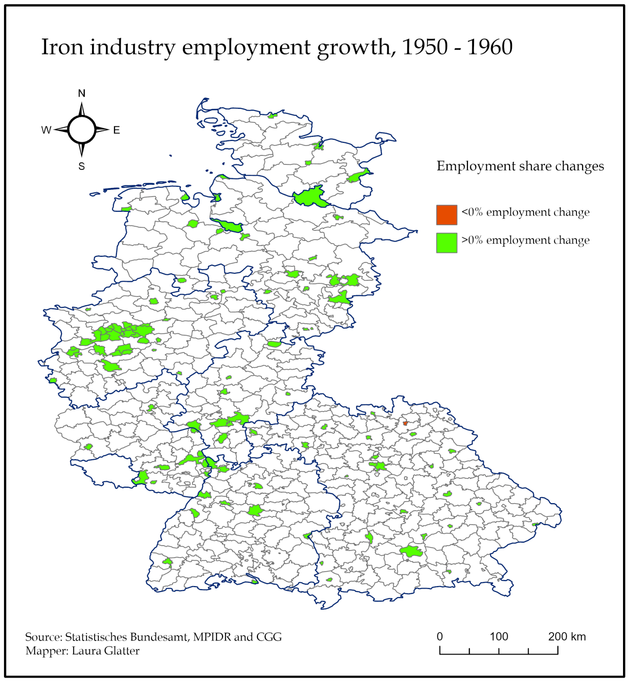


Figure 10 shows the employment share changes in the iron and metal production industry. Interestingly, all but one city above 10,000 inhabitants recorded an increase in employment shares of the iron and metal production industry.

Figure 11 gives an overview over manufacturing employment share changes. The visual representation highlights a pronounced dispersion in the distribution, revealing notable variations across different regions. Particularly within the Ruhr industrial area, cities exhibited

Figure 10: Iron and metal production industry employment growth



a marked decline in manufacturing employment shares. Conversely, cities in Hessen and Rheinland-Pfalz predominantly demonstrated an upward trend of manufacturing employment. In Niedersachsen, a heterogeneous pattern emerges, with some cities observing an increase while others experienced a decline. Notably, Bremen reported a decline in manufacturing shares, while Hamburg and a few cities in Schleswig-Holstein showcased an increase. In Bayern, the majority of independent cities exhibited an upward trajectory in manufacturing employment shares, although significant urban centers such as München, Augsburg, and Nürnberg experienced a decline. In Baden-Württemberg, cities in the southern region witnessed an increase, while those in the northern part encountered a decline, underscoring the heterogeneous pattern of manufacturing employment changes across different parts of West Germany.

Figure 12 shows the employment share changes in the services sector. While most cities in West Germany reported a decline in service employment shares, three locations stand out in recording an increase: the Ruhr area in Nordrhein-Westfalen, the city state of Hamburg and Wiesbaden in Hessen.

6.3 Baseline estimation

Table 4 presents the summary statistics of the included variables. The number of observations n for agriculture are higher than for the sectors due to higher data availability. On

Figure 11: Manufacturing industry employment growth

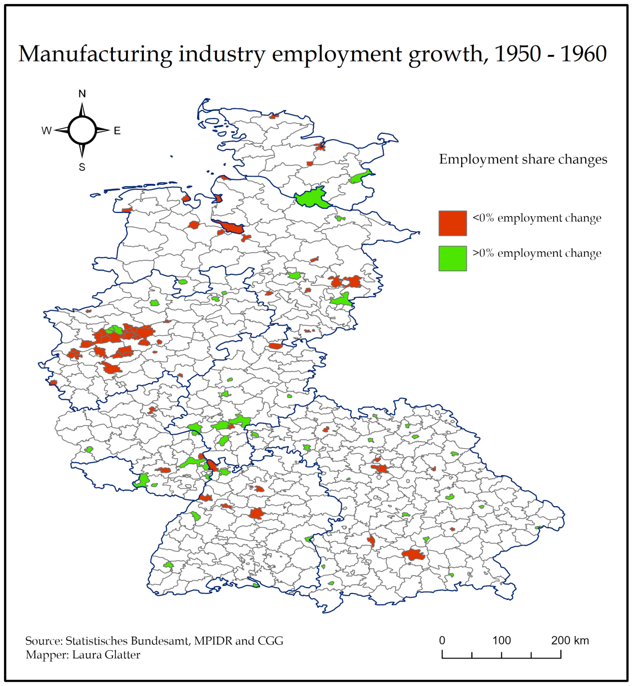
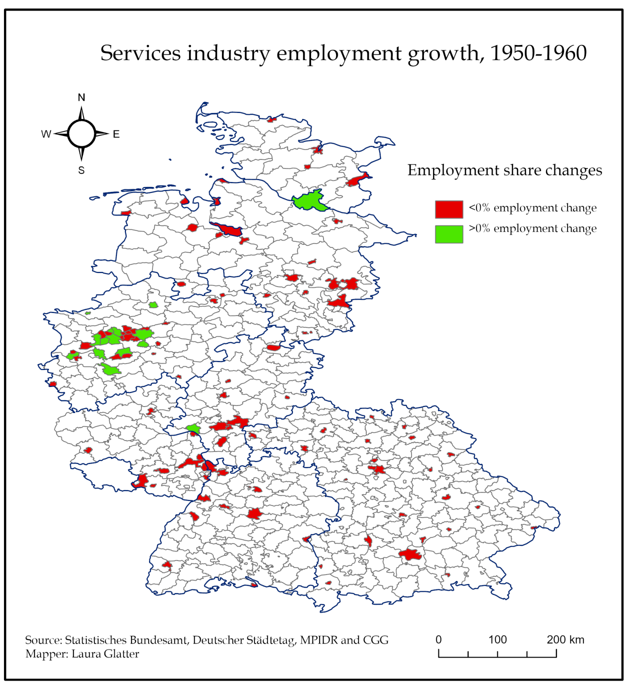


Figure 12: Services employment growth



average, agriculture employment and services employment change exhibit negative values. In contrast, iron and metal production experienced a significant average increase in employment shares, amounting to 6.88%. Manufacturing employment change shows high variation, with an average value of 0.85%. Cities, on average, witnessed an increase of expellee shares of 4.84%. The average population of a city was 93,520 people, and its average distance from the inner German border was 151.27 kilometers. In 1945, approximately 34% of an average city's housing stock was destroyed. Additionally, 12% of the population in 1946 were expellees. For the pre-war characteristics, the average city had an agricultural employment share of 14.82% in 1939, an industry share of 48% in 1939 and turnover per capita of 3.73 German Mark in 1935 on average.

Table 4: Summary Statistics

Variable	N	Mean	Min	Max
Agriculture Change	206	-1.73	-16.3	7.28
Mining Change	115	-0.02	-10.63	12.87
Iron Change	115	6.88	-2.20	23.72
Manuf. change	115	0.85	-5.33	18.99
Trade change	115	-0.75	-8.51	5.17
Service change	115	-1.85	-9.80	2.05
Transport change	115	-0.84	-7.34	5.61
Expellee change	226	4.84	-11.38	15.65
Population	301	93.52	11.04	2202.24
Dist. inner border	215	151.27	0	323.72
Damage share	215	0.34	0.00	0.91
Expellees 1946	201	0.12	0.01	0.41
Agr. share 1939	215	14.82	1.02	65.65
Industry share 1939	201	0.48	0.15	0.79
Turnover pc 1935	209	3.73	0.31	16.85

To assess the correlation between expellee inflows and changes in the employment structure, I conducted an OLS regression for each employment group respectively, including all control variables. Table 5 presents the results for all eight occupation groups. Control variables are included but not reported for conciseness.

Table 5: OLS regressions for employment share changes of different industries

	(1) Agriculture	(2) Mining	(3) Iron	(4) Manufacturing
Expellee change	0.10	0.17	0.55***	-0.31*
	(0.089)	(0.112)	(0.179)	(0.182)
N	167	95	95	95
Adj. R^2	0.399	0.444	0.099	0.156
	(5) Construction	(6) Trade	(7) Services	(8) Transport
Expellee change	-0.10	-0.10	0.09*	-0.09
	(0.088)	(0.109)	(0.052)	(0.073)
N	95	95	95	95
Adj. R^2	0.122	0.252	0.475	0.104

All control variables included, regression calculated in Stata by the Author

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Column 1 shows a positive correlation between expellee inflows and agricultural employment changes; however, this association is not statistically significant. Similarly, Column 2 demonstrates a positive correlation between expellee inflows and mining employment changes, also without statistical significance. In contrast, the results in Column 3 present a highly significant correlation between expellee inflows and changes in iron and metal production employment. A 10% increase in the expellee share is associated with an average increase of 5.5% in the iron and metal production employment share, highlighting a strong relationship between expellee inflows and employment dynamics in this sector. Moving to Column 4, a negative correlation is observed between expellee inflows and manufacturing employment changes. A 10% increase in the expellee share is correlated with a 3.1% decline in the manufacturing employment share. This correlation is statistically significant at the 10% level. The results for the construction and trade sectors, presented in Column 5 and 6, also suggest a negative relationship between expellee inflows and employment share changes. However, these correlations are not statistically significant. Column 7 explores the association between the expellee inflows and employment share changes in the services sector. A 10% increase in expellee shares is associated with a 0.9% increase in the services employment share. This result is statistically significant at the 10% level. Finally, in Column 8, the results present a negative relationship between expellee inflows and transport employment shares; however, this result is not statistically significant. Subsequently, I will present the detailed results for agriculture, iron and metal production, manufacturing and services sectors.

Table 6 presents the results of the OLS regressions for the agricultural sector. The table consists of four columns, each representing a different regression model with varying sets of control variables. In Column 1, without the inclusion of any control variables, expellee inflows are positively associated with agricultural employment increases. The coefficients remain statistically significant with the inclusion of city controls (Column 2) and post-war controls (Column 3). However, in Column 4, the introduction of pre-war control variables results in statistical insignificance of the coefficient. As the agricultural share in 1939 exhibits a strong statistical significant at the 1% level, this result suggests that the change in employment shares in the agricultural sector can largely be explained by its pre-war employment shares. This suggests that the relationship between expellee shares and agricultural employment is influenced by pre-war factors.

The sample size (n) ranges from 192 in Column 1 to 167 in Column 2. Note that the sample size varies with the availability of data for the cities. The R-squared value of 0.399 in Column 4 indicates that the model explains approximately 39.9% of the total variation in agricultural employment change, suggesting a reasonable fit.

In summary, the OLS regression results demonstrate a weak positive relationship between expellee share changes and changes in agricultural employment in West German cities in the 1950s, with no statistical significance.

Table 6: Agricultural employment change and expellee shares: OLS regression

	(1) No controls	(2) City controls	(3) Post-war controls	(4) All controls
Expellee change	0.32***	0.32***	0.35***	0.10
	(0.065)	(0.070)	(0.087)	(0.089)
Population		0.00	0.00	-0.00
		(0.000)	(0.000)	(0.000)
Distance to inner border		-0.00	0.00	0.01
		(0.003)	(0.005)	(0.004)
Damage share			0.99	-2.14*
			(0.886)	(1.115)
Expellee share 1946			4.59	-1.87
			(6.473)	(5.719)
Agricultural share 1939				-0.12***
				(0.029)
Industrial share 1939				-0.96
				(1.571)
Turnover p.c. 1935				0.02
				(0.078)
Intercept	-3.28***	-3.21***	-4.65***	0.11
	(0.455)	(0.679)	(1.592)	(1.620)
N	192	182	167	167
Adj. R^2	0.206	0.209	0.217	0.399

Standard errors in parentheses

All controls include: City controls, post-war controls and pre-war controls

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7 shows the results for the iron and metal production industry. In Column 1, the regression is conducted without any control variables. The coefficient for expellee change is 0.20 and is statistically significant at the 10% level. In Column 2, city controls are added to the regression. The coefficient for expellee change increases to 0.27 and becomes statistically significant at the 1% level. In Column 3, post-war controls are introduced to the regression model. The coefficient for expellee change further increases to 0.48 and remains highly statistically significant at the 1% level. This indicates that the relationship between expellee shares and iron employment change is robust even after accounting for city-level and post-war characteristics. Lastly, Column 4 includes all controls, incorporating city controls, post-war controls, and pre-war controls. The coefficient for expellee change continues to rise, reaching 0.55 and remaining highly significant at the 1% level. This comprehensive model indicates that expellee inflows have a strong and positive association with iron and metal production employment change, with a 10% increase in expellee shares being associated with a 5.5% increase in iron and metal production employment.

Among the control variables, none of them is statistically significant in the full model, suggesting that they do not explain the iron and metal production employment increases.

The sample size (n) varies across the regressions, ranging from 95 to 111, with a total of 95 observations used in the final model. The adjusted R-squared values provide an indication of the model's goodness of fit, amounting to 0.099 in the complete model. This value suggests that the selected variables explain only a small proportion of the total variation in iron and metal production employment change.

In conclusion, the results from the OLS regressions consistently demonstrate a significant and positive relationship between expellee shares and iron employment change. However, the goodness-of-fit is relatively low.

Table 7: Iron and metal production employment change and expellee shares: OLS regression

	(1) No controls	(2) City controls	(3) Post-war controls	(4) All controls
Expellee change	0.20*	0.27***	0.48***	0.55***
	(0.105)	(0.103)	(0.156)	(0.179)
Population		-0.00**	-0.00*	-0.00
		(0.001)	(0.001)	(0.001)
Distance to inner border		-0.01*	-0.01	-0.01
		(0.005)	(0.006)	(0.007)
Damage share			-3.48	-2.18
			(2.722)	(3.038)
Expellee share 1946			6.48	9.02
			(10.769)	(11.807)
Agricultural share 1939				0.06
				(0.054)
Industrial share 1939				-1.89
				(3.216)
Turnover p.c. 1935				-0.06
				(0.178)
Intercept	5.68***	7.13***	6.06*	6.01
	(0.786)	(1.129)	(3.057)	(3.736)
N	111	104	95	95
Adj. R^2	0.018	0.061	0.108	0.099

Standard errors in parentheses

All controls include: City controls, post-war controls and pre-war controls

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8 presents the results for the manufacturing industry. Column 1 provides the results for the regression analysis without any control variables. The coefficient for expellee change is -0.31, demonstrating a statistically significant negative relationship at the 5% level. In Column 2, the introduction of city controls leads to a slightly reduced coefficient for expellee change (-0.19), which is not statistically significant. This indicates that the influence of expellee shares on manufacturing employment change may be influenced by city-level characteristics, especially as the coefficient for population is statistically significant and negative. In Column 3, post-war controls are added to the regression model. This coefficient for expellee change indicates a significant negative impact at the 5% level. Finally, Column 4 includes all controls. In this comprehensive model, the coefficient for expellee change is -0.34, remaining statistically significant at the 10% level. This suggests that a 10% increase in expellee shares is associated with a decrease of 3.4% in manufacturing employment. These results imply that even after considering various control variables, expellee share changes still exhibit a negative relationship with changes in manufacturing employment.

Among the control variables, population and distance to inner German border consistently show negative coefficients, which are statistically significant in most cases. This suggests that larger populations and regions located further away from the inner German border tend to experience stronger decreases of manufacturing employment. Moreover, the inclusion of additional control variables such as the damage share and expellee share in 1946 reveals important insights. The coefficient for the expellee share in 1946 is negative and statistically significant at the 1% level. This indicates that higher expellee shares in 1946 are associated with greater declines in manufacturing employment in cities. Furthermore, more destroyed cities show a higher decline in manufacturing employment. Furthermore, cities with a higher pre-war industrial share show a higher decline in manufacturing employment.

The sample size (n) in the final model is 95 observations. The adjusted R-squared value amounts to 0.156, indicating that 15.6% of the total variation in manufacturing employment change can be explained by the model.

In summary, the OLS regression results reveal a significant negative relationship between expellee shares and changes in manufacturing employment, with other proximate determinants exhibiting statistical significance as well.

Table 8: Manufacturing employment change and expellee shares: OLS regression

	(1) No controls	(2) City controls	(3) Post-war controls	(4) All controls
Expellee change	-0.31**	-0.19	-0.39**	-0.34*
	(0.134)	(0.127)	(0.164)	(0.182)
Population		-0.00**	-0.00***	-0.00***
		(0.001)	(0.001)	(0.001)
Distance to inner border		-0.01	-0.02**	-0.02**
		(0.007)	(0.007)	(0.008)
Damage share			-6.06**	-5.38**
			(2.405)	(2.669)
Expellee share 1946			-29.16***	-29.47***
			(10.173)	(10.299)
Agricultural share 1939				0.03
				(0.051)
Industrial share 1939				-5.14*
				(3.078)
Turnover p.c. 1935				0.26
				(0.180)
Intercept	2.83***	4.11***	11.70***	12.21***
	(1.051)	(1.549)	(2.895)	(3.078)
N	111	104	95	95
Adj. R^2	0.044	0.064	0.143	0.156

Standard errors in parentheses

All controls include: City controls, post-war controls and pre-war controls

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9 presents the results of the OLS regression analysis examining the relationship between services employment change and expellee shares. When no controls are included (Column 1), the coefficient for expellee change is 0.24, indicating a positive relationship with services employment change. This coefficient is statistically significant at the 1% level. In Column 2, city controls are added. The coefficient for expellee share changes decreases slightly to 0.16 but remains statistically significant at the 1% level. With the inclusion of post-war controls in Column 3 and pre-war controls in Column 4, the coefficient decreases further to 0.09 and remains statistically significant at the 10% level. A 10% increase in expellee shares is associated with a 0.9% increase in services employment shares.

The control variable of population is strongly associated with services employment changes, suggesting that larger cities experienced a stronger increase in services employment. Furthermore, more destroyed cities, as well as more agricultural and industrial cities in 1939, also show a strong positive association with services employment shares.

95 observations are used for the full regression in Column 4. The adjusted R-squared value amounts to 0.475, suggesting that 47.5% of the total variation in the dependent variable can be explained by the model. In summary, the results suggest a positive association of expellee inflows and services employment increases.

Table 9: Services employment change and expellee shares: OLS regression

	(1) No controls	(2) City controls	(3) Post-war controls	(4) All controls
Expellee change	0.24***	0.16***	0.11*	0.09*
	(0.046)	(0.043)	(0.058)	(0.052)
Population		0.00***	0.00***	0.00***
		(0.001)	(0.001)	(0.001)
Distance to inner border		0.01***	0.01**	0.00
		(0.002)	(0.003)	(0.003)
Damage share			3.00**	3.21**
			(1.385)	(1.447)
Expellee share 1946			3.93	5.18
			(6.199)	(5.756)
Agricultural share 1939				0.04*
				(0.019)
Industrial share 1939				3.55***
				(1.249)
Turnover p.c. 1935				-0.10
				(0.073)
Intercept	-3.41***	-4.34***	-5.66***	-6.99***
	(0.345)	(0.373)	(1.560)	(1.864)
N	111	104	95	95
Adj. R^2	0.179	0.352	0.420	0.475

Standard errors in parentheses

All controls include: City controls, post-war controls and pre-war controls

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.4 Geographically-weighted regression

Table 10 presents the results of the GWR analysis for the agriculture sector. Two model specifications are presented: one without any controls (Column 1) and another with all controls included (Column 2). In Column 1, the coefficient for expellee change is 0.144, indicating a positive association between expellee shares and agriculture employment change in West German cities. However, this coefficient is only marginally significant at the 10% level. The inclusion of additional control variables in Column 2 leads to a decrease in the coefficient value for expellee change and statistical insignificance.

Among the control variables, the agriculture share in 1939 exhibits a significant negative association with agriculture employment change. This suggests that cities with a higher agriculture share before the war experienced a greater decline in agriculture employment.

Table 10: Agriculture employment change and expellee shares: GWR regressions

	(1) No controls	(2) All controls
Expellee change	0.144*	0.029
	(0.078)	(0.111)
Area		-0.001
		(0.002)
Distance to inner border		0.007
		(0.006)
Damage share		0.134
		(1.573)
Agriculture share 1939		-0.067**
		(0.032)
Population 1939		0.000
		(0.000)
Expellee share 1946		9.696
		(8.016)
Intercept	-2.199***	-2.500
	(0.570)	(2.070)
N	134	134
Adj. R^2	0.360	0.558

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Regression calculated in GIS by the Author

Figure 13 depicts the coefficient map of for the GWR regression for the agriculture sector. This spatial representation emphasizes the importance of examining relationships at a local level, as the coefficients vary significantly across West German counties. In the southern region, there is a negative relationship between expellee share changes and agricultural employment changes. Particularly in the Ruhr area, this negative relationship is pronounced, with coefficient values reaching as low as -0.10. Conversely, in the northern part, the relationships are positive, with coefficients reaching as high as 0.20 in Schleswig-Holstein and Niedersachsen. In Bayern, coefficient values are slightly positive. These findings indicate that expellee share changes are associated with an increase in agricultural employment in cities in outflow states and a significant decrease in agriculture employment changes in inflow states. These contrasting findings might explain why the coefficient is not statistically significant, as the relationship varies significantly depending on the region. Nevertheless, it is important to interpret these results cautiously.

Figure 13: GWR Map Agriculture

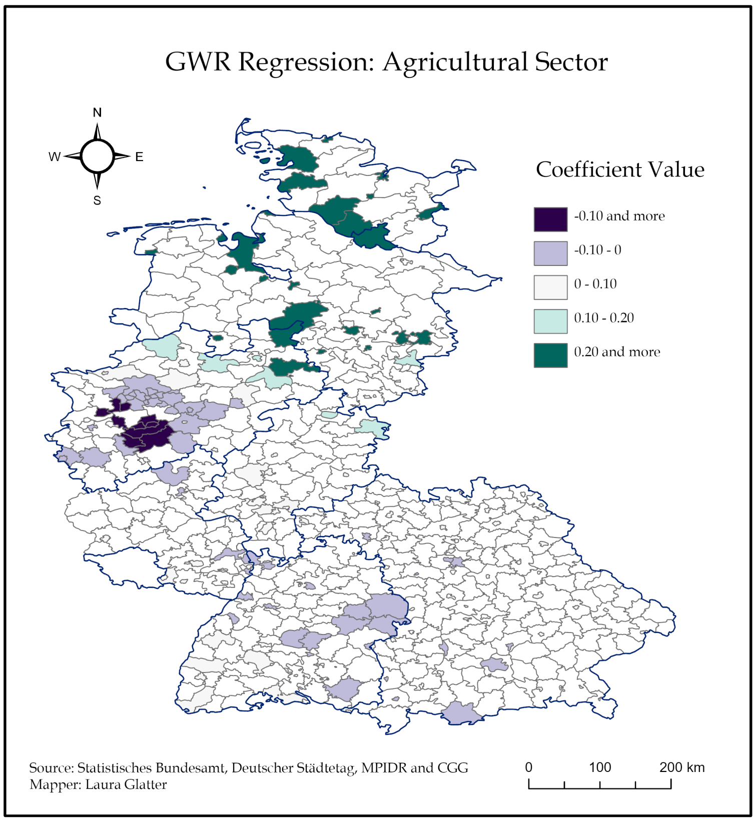


Table 11 presents the GWR results for the iron and metal production industry. In Column 1, the coefficients for expellee change is 0.212, indicating a positive association between expellee shares and iron employment change. However, this coefficient is not statistically significant. When additional control variables are introduced in Column 2, the coefficient for expellee change becomes statistically significant at the 1% level with a value of 0.448. This suggests that expellee share changes have a significant positive relationship with changes in iron and metal production employment when accounting for other factors.

Among the control variables, only the distance to the inner border exhibits a statistically significant association with iron employment change, showing a negative relationship. This implies that cities closer to the inner border experienced larger declines in iron employment.

In summary, the GWR results indicate a significant positive relationship between expellee shares and changes in iron and metal production employment when controlling for other factors. However, the low explanatory power of the model has to be kept in mind and will be further discussed in Section 6.5.

Table 11: Iron and metal production employment change and expellee shares: GWR regressions

	(1) No controls	(2) All controls
Expellee change	0.212	0.448***
	(0.142)	(0.166)
Area		-0.001
		(0.006)
Distance to inner border		-0.011*
		(0.006)
Damage share		-2.787
		(2.273)
Agriculture share 1939		0.067
		(0.055)
Population 1939		-0.000
		(0.000)
Expellee share 1946		4.938
		(9.716)
Intercept	5.327***	6.540***
	(1.104)	(2.707)
N	92	92
Adj. R^2	0.084	0.086

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Regression calculated in GIS by the Author

Figure 14 shows the spatial distribution of the coefficient values across West German cities. Note that the coefficient values do not vary to a great extent, ranging from 0.4 to 0.5. Hence, this map shows only the distinction between the coefficient values ranging at the lower end, between 0.4 and 0.45, and at the higher end, between 0.45 to 0.5. The map shows that expellee share changes are associated with a lower increase in the northern region, while they are associated with a higher increase in the southern part. Nevertheless, all cities show a significant increase of iron and metal production employment with a higher inflow of expellees. This indicates that expellees contributed to West German industrialization by seeking out jobs in the iron and metal production sector and migrating towards cities with those employment opportunities.

Figure 14: GWR Map Iron and Metal Production

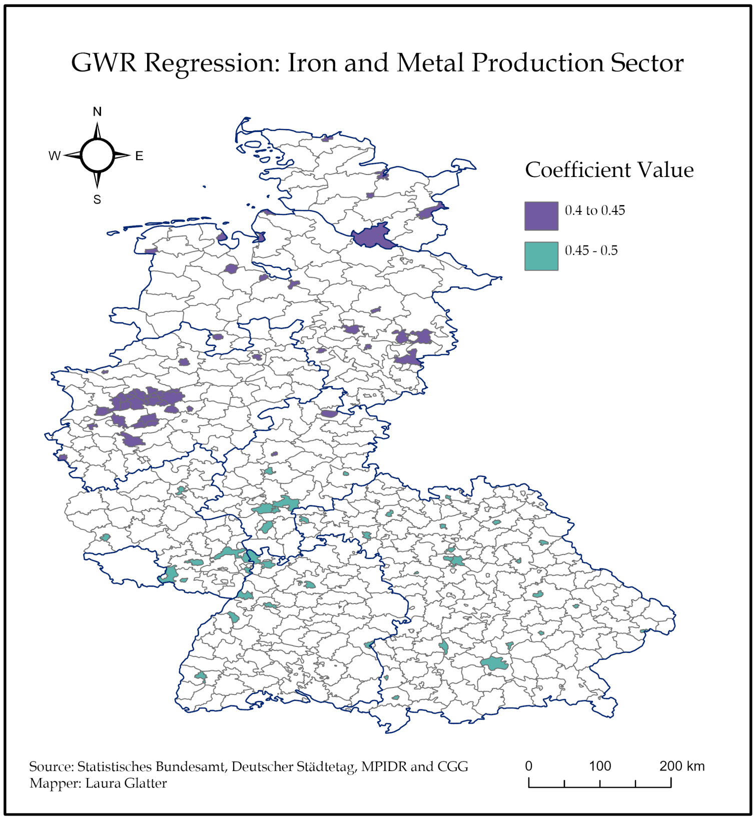


Table 12 presents the results of the GWR analysis for the manufacturing sector . In Column 1, the coefficient for expellee share change is -0.363, indicating a negative association between expellee shares and manufacturing employment change. This coefficient is statistically significant at the 5% level. When additional control variables are introduced in Column 2, the coefficient for expellee change remains negative and statistically significant at the 5% level, with a value of -0.383. This suggests that a 10% increase in expellee shares decreases the manufacturing employment share by 3.83%.

Among the control variables, the distance to the inner border exhibits a statistically significant negative association with manufacturing employment change in both model specifications. This implies that regions closer to the inner border experienced larger declines in manufacturing employment.

Table 12: Manufacturing employment change and expellee shares: GWR regressions

	(1) No controls	(2) All controls
Expellee change	-0.363**	-0.383**
	(0.161)	(0.194)
Area		-0.001
		(0.007)
Distance to inner border		-0.022***
		(0.007)
Damage share		-4.316
		(2.660)
Agriculture share 1939		0.062
		(0.065)
Population 1939		-0.000
		(0.000)
Expellee share 1946		-23.763***
		(11.456)
Intercept	3.210**	10.671***
	(1.257)	(3.165)
N	92	92
Adj. R^2	0.151	0.153

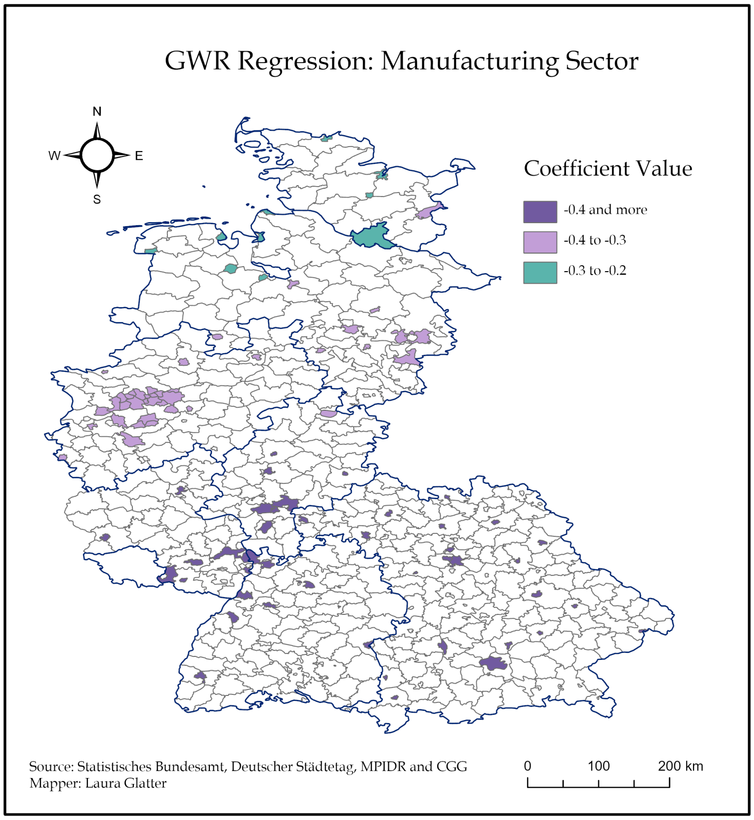
Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Regression calculated in GIS by the Author

Figure 15 shows the spatial variation in the coefficient values for the GWR analysis for the manufacturing sector. Note that all coefficients exhibit negative values. However, the negative effect of expellee inflows are particularly pronounced in the southern states of Bayern, Baden-Württemberg, and the southern parts of Hessen and Rheinland-Pfalz. In the northern regions of Schleswig-Holstein, Hamburg and some parts of Niedersachsen, the negative effect is not as high in the southern part. Hence, one can conclude from this map that higher expellee inflows led to a particularly strong decrease of manufacturing employment in southern West Germany, while the decrease was not as pronounced in the northern regions. However, these results have to be interpreted with caution, as the model diagnostics discussed in Section 6.5 suggest low explanatory power.

Figure 15: GWR Map Manufacturing



Lastly, Table 13 presents the results of the GWR analysis for the services sector. Both the results in Column 1, without any controls, as well as in Column 2, with all controls, show a strong and statistically significant relationship of expellee inflows and service employment increases. On average, a 10% expellee inflow leads to a 1.19% increase in service employment shares. This result is statistically significant at the 1% level.

Among the control variables, the results show that cities located further away from the inner German border exhibit higher increases in services employment, as well as cities which were more destroyed after the Second World War.

Table 13: Services employment change and expellee shares: GWR regressions

	(1) No controls	(2) All controls
Expellee change	0.218***	0.119***
	(0.061)	(0.070)
Area		0.001
		(0.002)
Distance to inner border		0.009***
		(0.003)
Damage share		2.460***
		(0.974)
Agriculture share 1939		0.001
		(0.027)
Population 1939		0.000
		(0.000)
Expellee share 1946		3.791
		(4.340)
Intercept	-3.078***	-5.853***
	(0.478)	(1.160)
N	92	92
Adj. R^2	0.370	0.551

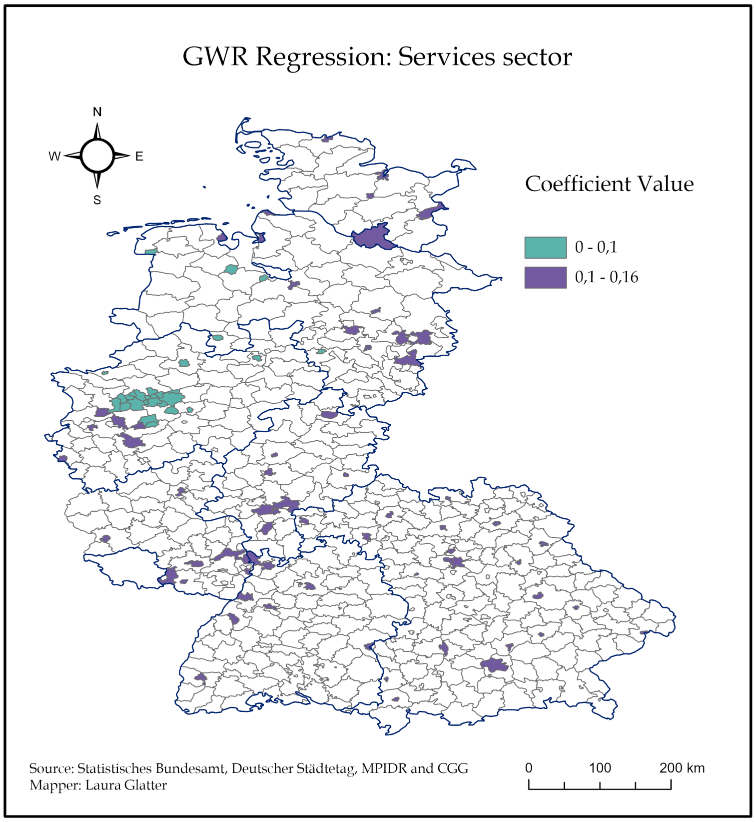
Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Regression calculated in GIS by the Author

Figure 16 presents the results of the regional variation of the coefficient values for the GWR regression. All cities exhibit a positive association. However, cities in the Ruhr area show a smaller increase in employment shares, amounting to a maximum of a 0.1% employment change with a 10% expellee inflow, on average. Other cities, which are not located in the Ruhr area, show a significantly higher increase in services employment with expellee inflows, with the coefficient values amounting up to 0.16. Hence, the results suggest a strong positive association between expellee inflows and employment share changes in the service sector.

Figure 16: GWR Map Services



6.5 Model diagnostics and robustness checks

6.5.1 Model diagnostics

Table 14 provides the model diagnostics results of the GWR for the agriculture sector. 134 cities (features) are included in the regression. The chosen number of neighbors, 31, indicates that for each city in the regression, the model takes into account the 31 nearest neighboring cities when estimating the coefficients. This value was selected based on the lowest Akaike Information Criterion (AICc) with a value of 500.1691, suggesting that it provides a good balance between model complexity and fit. By including a smaller number of neighbors, the model places greater emphasis on the influence of nearby cities in capturing the spatial relationships. The adjusted R-squared value indicates that approximately 55.79% of the spatial variation in agriculture employment change can be explained by the model. This implies that the model captures a substantial portion of the variability in the response variable, suggesting a reasonably good fit to the data. The sigma-squared value of 3.3126 represents the least-squared estimate of the variance for the residuals in the model. A high sigma-squared value suggests that the residuals have a relatively large spread, indicating that the model may have difficulty capturing all the variation in the data. A lower sigma-squared MLE value suggests a better fit of the model to the data. In this case, the sigma-squared MLE value is 2.5985. This indicates that, on average, the model's predictions are closer to the observed values compared to the least-squared estimate of variance. The effective degrees of freedom value of 105.1138 represents the effective sample size for the GWR model. It takes into account the spatial autocorrelation and spatial heterogeneity in the data, and it suggests that the effective sample size is smaller than the actual number of cities (134) due to the spatially varying nature of the model. Overall, the diagnostics suggests a good fit of the model (ESRI 2023).

Table 14: Model Diagnostics: GWR Agriculture

Metric	**Value**
Number of Features	134
Number of Neighbors	31
R2	0.6539
AdjR2	0.5579
AICc	566.5365
Sigma-Squared	3.3126
Sigma-Squared MLE	2.5985
Effective Degrees of Freedom	105.1138

Table 15 presents the model diagnostics results for the iron and metal production sector. 92 cities (features) are included in the regression, with the chosen number of neighbors being 90. The decision to use 90 neighbors was based on the lowest AICc, which yielded a value of 500.1691. The adjusted R-squared value indicates that approximately 8.57% of the spatial variation in manufacturing employment change can be explained by the model. The sigma-squared value of 11.7629 represents the least-squared estimate of the variance for the model's residuals. The sigma-squared MLE value is 10.4823, which is much higher than in the GWR for the agriculture sector, suggesting a larger spread of the residuals. The effective degrees of freedom value of 81.9843 suggests that the effective sample size is smaller than the actual number of cities (92) due to the spatially varying nature of the model ESRI 2023. In summary, the model diagnositics suggest a moderate fit of the GWR model for the iron and metal production sector.

Table 15: Model Diagnostics: GWR Iron and Metal Production

Metric	**Value**
Number of Features	92
Number of Neighbors	90
R2	0.1863
AdjR2	0.0857
AICc	500.1691
Sigma-Squared	11.7629
Sigma-Squared MLE	10.4823
Effective Degrees of Freedom	81.9843

Table 16 presents the model diagnostics results for the manufacturing sector. 92 cities (features) and 68 neighbors are included in the regression. The AICc value amounted to 525.0039. The adjusted R-squared value indicates that approximately 15.26% of the spatial variation in manufacturing employment change can be explained by the model. The sigma-squared value of 15.2399 suggests that the residuals have a relatively large spread, indicating that the model may have difficulty capturing all the variation in the data. Furthermore, the sigma-squared MLE value is 13.1957, higher than both in the iron and agriculture GWR models. The effective degrees of freedom value of 79.6597 suggests that the effective sample size is smaller than the actual number of cities (92) due to the spatially varying nature of the model ESRI 2023. In summary, the model diagnostics suggest a moderate fit of the GWR model for the manufacturing industry.

Table 16: Model Diagnostics: GWR Manufacturing

Metric	**Value**
Number of Features	92
Number of Neighbors	68
R2	0.2676
AdjR2	0.1526
AICc	525.0039
Sigma-Squared	15.2399
Sigma-Squared MLE	13.1957
Effective Degrees of Freedom	79.6597

Table 17 provides the model diagnostics results for the services sector. 92 cities (features) are included in the regression. The chosen number of neighbors is 35. This value was selected based on the lowest AICc with a value of 320.4118, the smallest value compared to the previous GWR models. The adjusted R-squared value indicates that approximately 55.12% of the spatial variation in services employment change can be explained by the model. The sigma-squared value of 1.5700 suggest that residuals have a low spread, indicating a better fit of the model to the data. Furthermore, the sigma-squared MLE is 1.2606, further suggesting a good fit of the model. The effective degrees of freedom value of 73.8674 represents the effective sample size for the GWR model, suggesting that the effective sample size is smaller than the actual number of cities (92) (ESRI 2023). However, the model diagnostics suggest a very good fit of the GWR model for the service sector data.

Table 17: Model Diagnostics: GWR Services

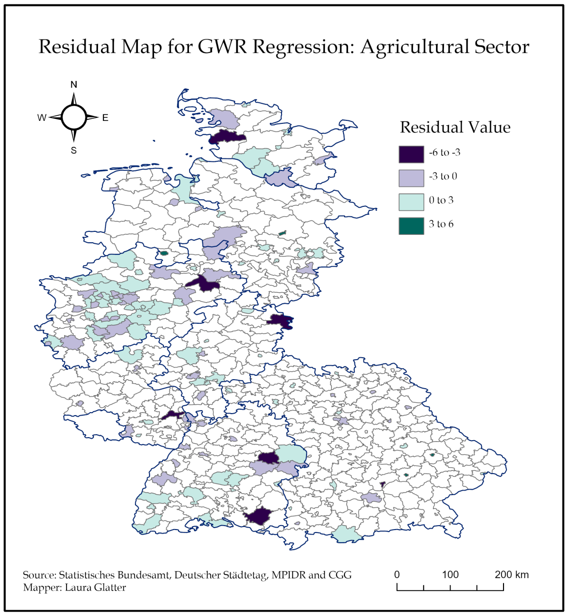
Metric	**Value**
Number of Features	92
Number of Neighbors	35
R2	0.6406
AdjR2	0.5512
AICc	320.4118
Sigma-Squared	1.5700
Sigma-Squared MLE	1.2606
Effective Degrees of Freedom	73.8674

6.5.2 Robustness checks

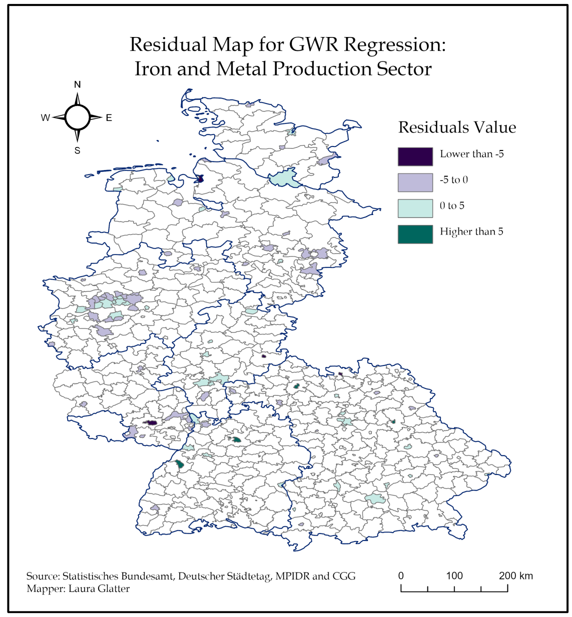
To assess the explanatory power of the local regression models, diagnostic maps serve as a valuable tool (ESRI 2023). First, Figure 17 presents the residual maps, which depict the differences between the observed values of the dependent variables and the corresponding predicted values estimated by the local regression models. The residual values for the agriculture sector exhibit considerable spatial variation throughout West Germany, without a clear discernible pattern. Some cities display higher residual values, reaching up to -6, indicating relatively poorer model predictions. However, the majority of residuals fall within the range of -3 to 3, suggesting that the predicted values closely approximate the observed values in these local regressions. For the iron and metal production sector, most residual values range between -5 and 5, demonstrating a larger deviation compared to the agricultural sector. The number of outliers with values exceeding 5 or below -5 is limited. In the manufacturing sector GWR, while the northern part of West German exhibits relatively smaller residual variations, ranging from -5 to 5, the areas around Kaiserslautern and Nürnberg display substantially higher residual values, indicating a greater discrepancy between predicted and observed values. Lastly, the services sector GWR shows a very low regional variation in its residuals as well as a small range of residual deviations, ranging from -3 to 3. Thus, the residual maps indicate that the local regressions possess a better fit of the data for the agriculture and services sector, while the regressions for the iron and metal production and the manufacturing sector show greater variation in predicted values compared to observed values.

Figure 17: Residual Maps

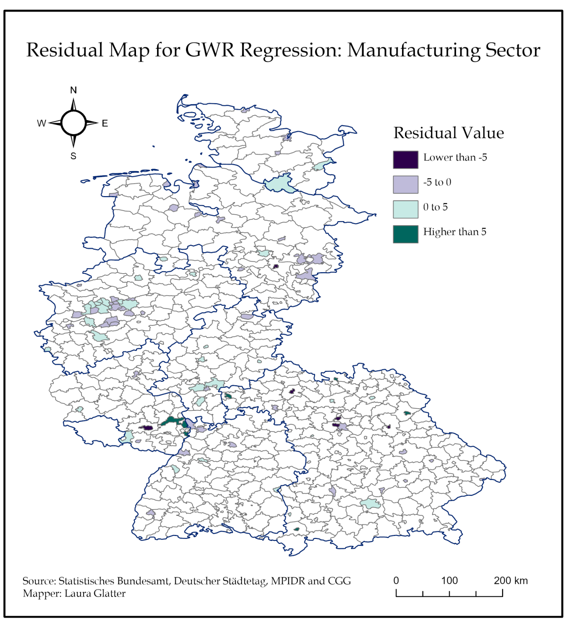
(a) Agriculture



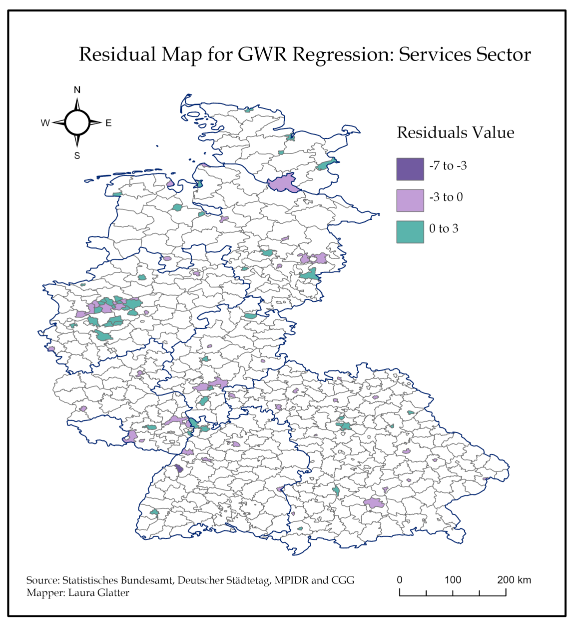
(b) Iron



(c) Manufacturing



(d) Services



Second, Figure 18 showcases the local R-squared value maps. These maps provide insights into the extent to which the local regressions explain the variation in the response variables, namely employment share changes in agriculture, iron and metal production, manufacturing and services across each city. In general, the R-squared values for the agricultural sector are relatively high. The map reveals that cities located in the northern region exhibit a higher explanatory power of the model compared to those in the southern regions, with some cities displaying R-squared values lower than 0.4. For the iron and metal production industry, the explanatory power is generally lower than that of the agricultural model, with R-squared values ranging from 0.17 to 0.2. Bayern exhibits lower R-squared values, although the differences are not substantial compared to other regions in West Germany. In the local regression models for the manufacturing sector, R-squared values also demonstrate limited variation, ranging from 0.25 to 0.3. Slightly higher values of explanatory power can be observed in Nordrhein-Westfalen, Rheinland-Pfalz and Hessen, although the overall explanatory power of the local regressions remains relatively modest. Finally, the local R-squared values of the GWR model for the services sector show high a explanatory power, with values ranging from 0.5 to 0.7. Especially in the northern regions, the explanatory power is particularly pronounced. In summary, these findings reaffirm the substantial explanatory power of the model for the agricultural and services sector, while indicating a comparatively lower explanatory power and goodness of fit for the models in the iron and metal production sector and manufacturing sector.

6.6 Summary of findings

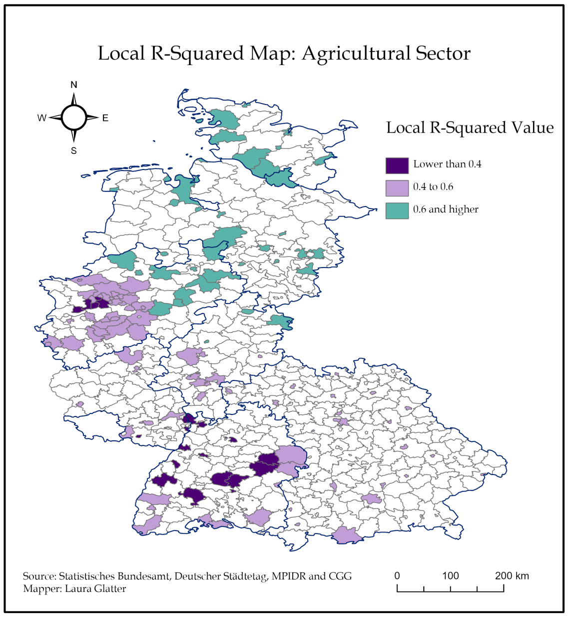
In conclusion, the findings from the empirical analyses highlight the significant explanatory power of the models for the agricultural and services sectors. While the expellee change coefficient does not exhibit statistical significance in relation to employment share changes in the agricultural model, the local results reveal interesting differences between northern and southern regions. Specifically, the northern region shows a positive change in employment shares, while the southern region displays a negative association. These contrasting regional relationships may contribute to the non-significance of the overall coefficient in the agriculture regression. Nevertheless, the divergent impacts of expellee inflows on the employment shares of agriculture in West German cities are noteworthy, as they vary significant depending on the geographical location.

The GWR model for the services sector not only exhibits the highest explanatory power but also reveals a positive and statistically significant relationship between expellee inflows and increases in services employment in West German cities. Therefore, the results of both the GWR and baseline estimation suggest that expellee inflows were a significant proximate determinant contributing to the higher employment shares observed in the services sector of West German cities during the 1950s.

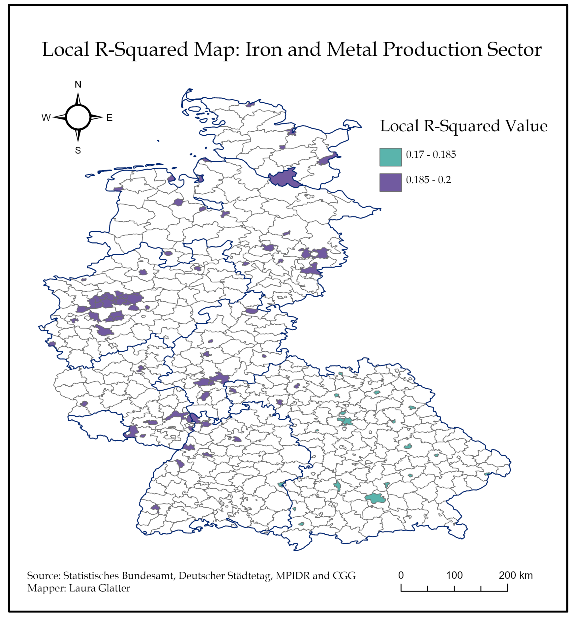
In the iron and metal production industry, higher expellee inflows are associated with

Figure 18: Local R-Squared Maps

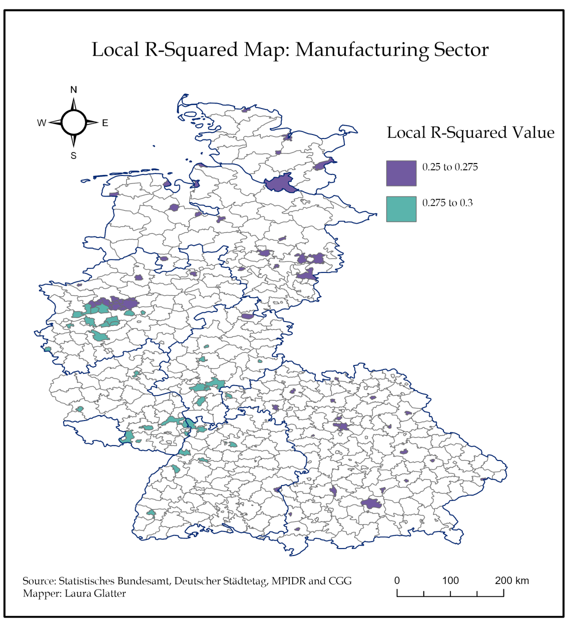
(a) Agriculture



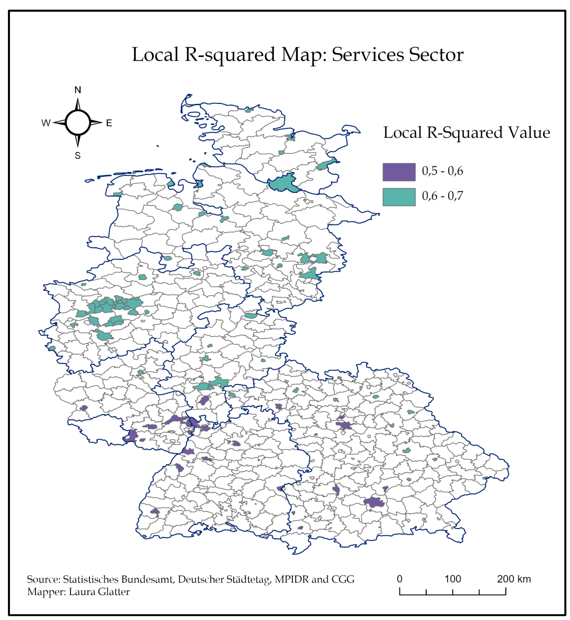
(b) Iron



(c) Manufacturing



(d) Services



a positive change in employment shares across all regions. However, the robustness checks suggest limited explanatory power of both the GWR and OLS model.

Similarly, in the manufacturing sector, all cities demonstrate a negative association between higher expellee inflows and employment share changes. Nevertheless, the robustness checks suggest a low explanatory power of the GWR and OLS models, suggesting that other proximate determinants may have played a more influential role in shaping employment dynamics.

Overall, these findings shed light on the complex interplay between expellee inflows and sector-specific employment dynamics and highlight the importance in taking regional disparities into account.

7 Discussion

As the empirical results indicate, expellee inflows were a significant proximate determinant in changing the employment structures of West German cities in the 1950s. Hence, the migration of expellees mattered for the economic developments in urban areas during that period. The results reveal four underlying mechanisms that explain the influence of expellee inflows on changes in employment structure. First, the pace of transitioning from the agricultural sector to other sectors relied heavily on the absorption capacity of cities. Second, the findings indicate that the expellee migration flows played a crucial role in accelerating sectoral change towards the industrial sector in urban areas by filling labor demand in the labor-scarce iron and metal production industry. Third, the declining urban manufacturing share implies a process of rural industrialization. Fourth, the results further suggest a sectoral shift towards the services sector. Again, it is crucial to acknowledge that multiple factors were likely at play in these developments, underscoring that expellee inflows should be regarded as a proximate determinant rather than the sole driving force.

7.1 Absorption capacity as a factor for transition out of agriculture

Existing literature on the economic impact of expellees has established them as a significant driver of sectoral change away from the agricultural sector (Peters 2022, Bauer, Braun, and Kvasnicka 2013, Braun and Kvasnicka 2014). Conventional sectoral change models suggest that sectoral change occurs when employment shares decrease in the agricultural sector and increase in non-agricultural sectors (Kuznets 1955). While my results partly corroborate these findings, I provide a more nuanced perspective by considering regional variations, showing that the successful integration of expellees depended on the capacity of cities to take in laborers. The results show that this absorption capacity of cities varied throughout West Germany. Industrial capacity and housing availability, which determine absorption capacity, play a crucial role in shaping expellee migration outcomes.

Specifically, the study shows a positive correlation between expellee inflows and agricultural employment in cities, although not statistically significant. However, the contrasting patterns of agricultural employment decreases in low-inflow and increases in high-inflow regions highlight the limited absorption capacity of cities in the latter. These regions were more agrarian and had a lower industrial capacity compared to heavily industrialized areas in low-inflow regions (Statistisches Bundesamt 1955d, p.28). Despite labor scarcity in the industrial sector, urban industries in high-inflow regions were unable to provide jobs to all incoming expelles, resulting in an increased share of agricultural employment. Furthermore, the disproportionately high influx of expellees to these regions led to reduced housing availability per capita, further constraining absorption capacity. In contrast, low-inflow regions exhibited higher absorption capacity due to their lower initial inflows and higher industrial capacity, resulting in a decline in the share of agricultural employment. Particularly in the Ruhr area the inflows are associated with a marked decline in agricultural employment shares.

These regional differences in absorption capacity align with the findings of Braun and Kvasnicka (2014), who documented faster sectoral change in low-inflow districts compared to high-inflow districts between 1950 and 1961. They argue that expellee inflows prompted migration from high-inflow to low-inflow districts, thus accelerating sectoral change in the latter. The GWR analysis conducted in my study supports this notion.

In summary, absorption capacity significantly influenced the pace of sectoral change. Low-inflow states with higher absorption capacity experienced a faster transition out of agriculture due to urban labor scarcity and high industrial capacity. In contrast, high-inflow states with limited absorption capacity face a slower transition due to the high initial influx of expellees. Thus, the long-lasting negative effects of the initial expellee inflow shock were particularly pronounced in overburdened states.

7.2 Reduction of urban labor scarcity in industry

Simultaneously with the decline of agricultural employment shares, a notable increase in iron and metal production employment shares occurred with the influx of expellees, suggesting that the employment structure transitioned towards industry.

One explanation for this phenomenon is the labor scarcity in urban areas resulting from their underutilized industrial capacity. According to Vonyó (2012, p.99), despite the destruction and post-war dismantlement, the urban industrial sector's capacity did not decrease. In fact, significant investments during the war resulted in West German industry having more physical capital in 1950 than before the Second World War. However, housing scarcity in cities prevented people from residing and working in urban areas, leading to underutilization of industrial capacity and labor scarcity (Vonyó 2012, p.99). Moreover, capital accumulation during the war was concentrated heavily in the urban industrial sector, while the rural economy experienced a significant reduction in resources. As a result, an imbalanced distribution of industrial capacity emerged in the West German economy after the war. Rural areas lacked sufficient industrial capacity to absorb surplus labor, while urban areas possessed surplus industrial capacity but suffered from labor scarcity. This created a pressing demand for labor in cities, particularly to fill the surplus industrial capacity (Vonyó 2012). As my results demonstrate a strong association between expellee inflows and increases in iron and metal production employment, their crucial role in meeting this high labor demand is highlighted. This finding is supported by Vonyó (2020), who identifies the reintegration of idle labor reserves into the production process as a key driver of production expansion in the early 1950s. This reintegration required a geographical reallocation of expellees from rural to urban areas, which I visualized in Section 6.1.3. While my research does not differentiate between the expellee share and the native share of employment increases, previous studies suggest that expellees transitioned out of agriculture more extensively than natives and were more likely to migrate (Bauer, Braun, and Kvasnicka 2013). I therefore conclude, in line with Vonyó (2020), that expellees played a significant role in increasing the iron and metal production employment share, thereby addressing the labor scarcity in this sector.

To gain a more nuanced understanding of these findings, it is interesting to explore sub-industries within the iron and metal production industry. Vonyó (2020, p.91) identifies production and investment goods as the primary drivers of continued expansion after 1950, sectors closely linked to Germany's motorization emerged as dominant forces. The car industry, in particular, benefited from the wartime legacy, as aircraft production was prohibited and remained shut down until 1955. To prevent their assets from being dismantled by the Allies, former aerospace manufacturers and suppliers swiftly redirected their production capabilities towards engineering motor vehicles for civilian and commercial use, enabling them to sustain their business (Scherner, Streb, and Tilly 2014, p.1010-1011). Hence, suggestive evidence indicates that the motorization industries played a significant role in driving the expansion of the iron and metal production sector.

7.3 Rural industrialization

As manufacturing can be classified as a sub-industry of industry, and the findings discussed above suggest that expellee inflows are associated with a faster transition out of agriculture towards industry, it is surprising that my results reveal decreasing manufacturing employment in cities. This finding appears contradictory to the findings of Peters (2022), who demonstrates a positive association between refugee allocation and manufacturing employment growth at the county level. However, Peters (2022) study uses a different unit of observation, encompassing both rural and urban areas, whereas my analysis focuses solely on cities. Notably, Peters (2022) highlights that rural areas experienced significant growth in manufacturing employment, as "(...) the policy of the military governments to settle refugees in less developed, agriculturally specialized locations led to industrialization and spurred rural development as an unintended consequence" (Peters 2022, p.2359). Through a counterfactual allocation analysis, Peters (2022) demonstrates that if expellees were more evenly distributed across rural and urban areas, the increase in manufacturing employment in rural labor markets would have been substantially smaller. Hence, the decline of manufacturing employment in urban areas found in my study indicates the rise of manufacturing employment in rural areas.

To promote manufacturing employment opportunities in rural areas such employment opportunities relocated from cities to rural regions. For instance, in 1949, M. Bold, the Deputy Director of the US Military Government in Bavaria, stated that "since refugees and bombed-out Bavarians now living in rural areas cannot move nearer to industrial jobs, such jobs must go to them. In fact, many world famous industries wanting to reestablish in Bavaria have already sought locations in non-industrial areas near idle workers" (Office of the Military Government for Germany 1949). Vonyó (2012, p.103) demonstrates that the decline of urban industry due to labor scarcity was offset by the expansion of rural industry.

As a result, expellees migrating to cities did not actively seek manufacturing jobs there since manufacturing employment opportunities were already on the rise in rural regions. The negative association between expellee inflows and manufacturing employment in cities suggests an increase in manufacturing employment in rural areas, implying the association of expellee relocation and the process of rural industrialization.

7.4 Structural transformation to services industry

Lastly, the influx of expellees played a significant role in increasing service employment shares, demonstrating a shift not only from agriculture to industry but also towards the service sector. Hence, the employment structure of the West German economy was structurally transformed. Existing literature characterizes structural transformation by "(...) a systemic fall over time in the share of labor allocated to agriculture, by a steady increase in the share of labor in services, and by a hump-shaped pattern for the share of labor in manufacturing" (Duarte and Restuccia 2010, p.134). The positive association between expelle inflows and the overall increase in service employment, coupled with the high explanatory power of this model, suggests that expellees were a significant determinant of this structural transformation.

It is worth noting that my findings differ from Peters (2022), who also examines service employment shares. Peters (2022) similarly observes a significant sectoral reallocation, with increased manufacturing employment and decreased agricultural employment, but finds no change in the service employment share. However, it is important to consider again that

Peters (2022) analyzes all West German counties, including both rural and urban areas, while my study focuses solely on urban areas. Consequently, the positive association between expellee inflows and increased service employment shares in urban areas, combined with Peters (2022) null findings, suggest that service employment shares increased with expellee inflows in urban areas, while they decreased in rural areas.

An intriguing aspect to explore is the breakdown of sub-industries within the services sector. These sub-industries encompass a wide range of areas such as housing, real estate, asset management, catering, arts and entertainment, sports management, news and media, funeral services and domestic services, among others. Due to this diverse composition of the services sector, it is challenging to determine which specific sub-industry drove the increase in service employment shares. However, one plausible explanation is the prominence of domestic services, which were predominantly female-dominated (Statistisches Bundesamt 1957a). As Figure 7 illustrated, domestic services constituted the second-largest occupational group among migrants from Schleswig-Holstein and Niedersachsen from 1950-1955, accounting for 16.0% and 15.4%, respectively. Therefore, the rise in service employment shares may reflect growth in domestic services, largely provided by women and capturing the migration of female expellees during the 1950s. Nonetheless, it is important to note that this evidence should be considered suggestive and not interpreted causally. Future research could delve into the gender impact on expellee migration and labor market dynamics in West Germany during the 1950s.

7.5 Limitations

One important limitation is that expellees were not the only migrating population group during the 1950s. Migration flows of natives and especially from refugees from the Soviet zone also occurred. With the divergence of the political situation in Soviet zone, approximately 1.1 million people relocated between 1950 and 1954. However, 30.2% of these relocating people were expellees, thereby contributing to the rise of expellee shares recorded in the data. Nevertheless, it is plausible that the non-expellee migrants also influenced employment shares in the industries under analysis, particularly given the similarities between their migration patterns and the internal migration patterns in West Germany. Notably, around 36.0% of the 1.1 million relocating migrants chose to settle in Nordrhein-Westfalen (Stahlberg 1957, p.48-53). Furthermore, native West Germans migrated as well. Braun and Weber (2021, p.5) demonstrate that the migration rate of natives was 1.1% in 1950. However, they also show that expellees were more likely to migrate, with a migration rate of 4.4% in the same year. Hence, although the migration of the other population groups of natives and migrants from the Soviet zone may have also influenced employment shares in West German urban labor markets, the evidence strongly indicates that expellees can be considered a significant proximate driver of sectoral reallocation in West Germany in the 1950s.

8 Conclusion

This study contributes to the understanding of the impact of expellee migration on West German labor markets in the 1950s. Expellees who were forcibly expelleed from the former East German provinces after the Second World War were found to be a significant determinant, alongside other factors, of the structural transformation of the West German labor market. Importantly, this study highlights the need to consider the spatial context of expellee migration flows, as well as the distinction between urban and rural labor markets.

By utilizing newly digitized data and constructing a novel dataset, this study provides evidence that expellees had a profound impact of the employment structure of West German cities during the 1950s. Diverging results for the agricultural sector show that regions experiencing a high initial inflow of expellees faced challenges due to the disproportionate strain on their housing availability and industrial capacity. In such regions, where the industrial capacity was insufficient to accommodate all job-seeking expellees, agricultural employment shares increased with the expellee inflow, hindering a faster transition out of agriculture. Conversely, regions with a low initial inflow of expellees had higher industrial capacity and labor scarcity, enabling expellees to find employment in industry. Thus, agricultural employment shares declined, thereby accelerating sectoral change out of agriculture towards industry. Correspondingly, the results show that expellee inflows were highly associated with increasing iron and metal production employment shares. Interestingly, urban areas across West Germany experienced a decline in manufacturing shares, indicating a shift of manufacturing activities to rural areas and facilitating the process of rural industrialization. With the strong association of expellee inflows and sectoral change of the urban labor markets in the 1950s, one can conclude that expellees were a proximate determinant of structural transformation during this period.

The analysis of this migration flow after the Second World War provides important lessons for handling migration events today. The results underscore the significance of ensuring an equitable distribution of migrants to foster successful integration and provide labor opportunities that enable them to make economic contributions. As demonstrated in this study, expellees made a significant economic contribution in the West German economy by accelerating sectoral change in urban labor markets.

9 Appendix

9.1 Overview of sources

Table 18: Sources of Dataset

Source	Unit	Variable	Year	Self-digitized
Statistisches Bundesamt (1960a), Statistisches Bundesamt (1952c), Statistisches Bundesamt (1953d), Statistisches Bundesamt (1954c), Statistisches Bundesamt (1955c), Statistisches Bundesamt (1956b), Statistisches Bundesamt (1957b), Statistisches Bundesamt (1958), Statistisches Bundesamt (1960b), Statistisches Bundesamt (1961)	Counties and independent cities	Expellee population (in 1000)	1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960	Yes
Statistisches Bundesamt (1960a), Statistisches Bundesamt (1952c), Statistisches Bundesamt (1953d), Statistisches Bundesamt (1954c), Statistisches Bundesamt (1955c), Statistisches Bundesamt (1956b), Statistisches Bundesamt (1957b), Statistisches Bundesamt (1958), Statistisches Bundesamt (1960b), Statistisches Bundesamt (1961)	Counties and independent cities	Population (in 1000)	1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960	Yes

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Table 18: Continued

Source	Unit	Variable	Year	Self-digitized
Statistisches Bundesamt (1951b), Statistisches Bundesamt (1951c), Statistisches Bundesamt (1952a), Statistisches Bundesamt (1952b), Statistisches Bundesamt (1953b), Statistisches Bundesamt (1953c), Statistisches Bundesamt (1954a), Statistisches Bundesamt (1954b), Statistisches Bundesamt (1955a), Statistisches Bundesamt (1955b), Statistisches Bundesamt (1956a), Statistisches Bundesamt (1957a)	Outflow states	Relocating expellees by occupation group	1950, 1951, 1952, 1953, 1954, 1955	Yes
Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1955), Deutscher Städtetag (1956), Deutscher Städtetag (1957), Deutscher Städtetag (1958), Deutscher Städtetag (1959), Deutscher Städtetag (1960)	Cities above 10,000 inhabitants	Population 31.12.	1952-1960	Yes

Continued on next page

Table 18: Continued

Source	Unit	Variable	Year	Self-digitized
Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1955), Deutscher Städtetag (1956), Deutscher Städtetag (1957), Deutscher Städtetag (1958), Deutscher Städtetag (1959), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Population 31.12.	1952-1960	Yes
Deutscher Städtetag (1951)	Cities above 10,000 inhabitants	Population 1939 (in 1000)	1939	Yes
Deutscher Städtetag (1950),Deutscher Städtetag (1951), Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Population 31.12. (in 1000)	1948-1951	Yes
Deutscher Städtetag (1950),Deutscher Städtetag (1951), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Employment absolute	1948, 1950, 1951, 1953, 1954, 1956, 1958, 1960	Yes
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Employment (in 1000)	1950	Yes

Continued on next page

Table 18: Continued

Source	Unit	Variable	Year	Self-digitized
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Agriculture Employment (in 1000)	1950	Yes
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Mining Employment (in 1000)	1950	Yes
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Iron and metal production Employment (in 1000)	1950	Yes
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Manufacturing Employment (in 1000)	1950	Yes
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Construction Employment (in 1000)	1950	Yes
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Trade Employment (in 1000)	1950	Yes

Continued on next page

Table 18: Continued

Source	Unit	Variable	Year	Self-digitized
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Services Employment (in 1000)	1950	Yes
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Transport Employment (in 1000)	1950	Yes
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Public Services Employment (in 1000)	1950	Yes
Deutscher Städtetag (1952)	Cities above 10,000 inhabitants	Not specified Employment (in 1000)	1950	Yes
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Agriculture employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes

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Table 18: Continued

Source	Unit	Variable	Year	Self-digitized
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Mining employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Iron and metal production employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Manufacturing employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Construction employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes

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Table 18: Continued

Source	Unit	Variable	Year	Self-digitized
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Trade employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Services employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Transport employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Public services employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes

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Table 18: Continued

Source	Unit	Variable	Year	Self-digitized
Deutscher Städtetag (1950), Deutscher Städtetag (1953), Deutscher Städtetag (1954), Deutscher Städtetag (1956), Deutscher Städtetag (1958), Deutscher Städtetag (1960),	Cities above 10,000 inhabitants	Not specified employment share	1948, 1953, 1954, 1956, 1958, 1960	Yes
Braun and Dwenger (2017)	Counties and independent cities	Flats damaged during the war as share of flats in 1945	1950	No
Braun and Dwenger (2017)	Counties and independent cities	Distance to inner German border	1950	No
Braun and Dwenger (2017)	Counties	Share of expellees	1946	No
Braun, Kramer, et al. (2021)	Counties and independent cities	Turnover per worker in labor force 1935	1950	No
Braun and Dwenger (2017)	Counties and independent cities	Agriculture employment share	1939	No

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Table 18: Continued

Source	Unit	Variable	Year	Self-digitized
Braun and Dwenger (2017)	Counties and independent cities	Industry employment	1939	No
Max Planck Institute for Demographic Research and Chair for Geodesy and Geoinformatics, University of Rostock (2011)	Counties and independent cities	Area	1950	No

9.2 Definitions of employment groups by the Statistical Yearbook of German Cities

Table 19: Definitions of employment groups by the Statistical Yearbook of German Cities

Employment group	Definition
Agriculture	Agriculture and animal husbandry, forestry and hunting, horticulture, deep-sea and coastal fishing, inland fishing
Mining	Coal mining and processing, lignite mining and processing, ore mining, salt mining and salt workers, other mining, quarrying, building materials and ceramics industry, energy industry

Continued on next page

Table 19 – continued from previous page

Employment group	Definition
Iron and metal production	Iron and steel production, iron and steel foundries, non-ferrous metal foundries, steel and iron construction, wagon construction, general mechanical engineering, construction of safes and strongrooms, locomotive construction, construction of office machines, apparatus and fittings construction, shipbuilding, road vehicle construction, wheelwrighting, aircraft construction, electrical engineering, precision mechanics and optics, metalware industry, locksmithing and forging
Manufacturing	Petroleum refining and coal value industry, basic chemical industry, plastics processing, rubber and asbestos processing, fine ceramics industry, glass industry, sawmill and woodworking, carpentry, furniture and woodwork industry, upholstered furniture manufacturing, cooperage, turnery and other carving material processing, manufacture of packaging materials, manufacture of baskets and brushes, wood finishing, manufacture of paper and paper products, printing, manufacture of leather and leather products, manufacture of textiles, wearing apparel, musical instruments, toys, sports goods, jewelry and related articles, manufacture of precious and semi-precious stones, mills, processing of precious stones, milling food and animal feed industry, bakery and confectionery, meat and fish processing, milk processing, edible fat production, sugar industry, fruit and vegetable processing, coffee, tea and spice processing, ice production and freezing, beverage production, tobacco production
Construction	Architecture, civil engineering and surveying, building and civil engineering, carpentry and roofing, building installation, plumbing and electrical installation, finishing trades, auxiliary building trades

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Table 19 – continued from previous page

Employment group	Definition
Trade	Wholesale and retail trade, publishing, advertising and other supporting trade activities, money, banking and stock exchange activities, insurance activities
Services	Housing and real estate management, asset management, catering industry, art, literature, theater, film and broadcasting industry, exhibition industry, private research, sports management, bathing and swimming facilities, news, writing and translation offices, photography industry, hairdressing industry, cleaning, security, and porterage industry, private funeral services, domestic services
Transport	German Federal Post, German Federal Railways, railways, road transport, shipping, waterways and port industry, aviation, auxiliary transport and support industry
Public services	Public administration, occupying powers and foreign representations, political and economic organizations, legal and economic consulting, churches, ideological associations, education, science, culture, welfare and social care, social security, healthcare and hygiene
Not specified	Without indicating the specific industry affiliation (Statistisches Bundesamt 1953a)

9.3 Definitions of employment groups by the Federal Statistical Office

Table 20: Definitions of employment groups by the Federal Statistical Office

Employment group	Definition
Agriculture and animal husbandry	Agriculture and animal husbandry, forestry and hunting, horticulture, sea and coastal fishing, inland fisheries
Industrial and manufacturing professions	Mining, stone miners and processors, glass makers, construction professions, metal producers and processors, electricians, chemical workers, plastics processors, wood processors, paper manufacturers, graphic professions, textile manufacturers and processors, leather manufacturers and leather and fur processors, food and beverage producers, auxiliary industrial occupations
Technical occupations	Engineers and technicians, specialized technical workers, machinists and related occupations
Trade and transport occupations	Commercial occupations, transport occupations, hospitality occupations
Home care, health care and community care occupations	Home economics occupations, cleaning occupations, health and personal care occupations, people care occupations
Administrative and legal occupations	Administrative and office occupations, legal and security guard, service and guard occupations
Education and art	Educational and teaching professions and pastoral workers, education and research professions, artistic professions
Not specified	Without indicating the specific industry affiliation (Statistisches Bundesamt 1956a, p.68)

9.4 Corrected Akaike Information Criterion

The corrected Akaike Information Criterion (AICc) for GWR is a criterion used to evaluate the goodness-of-fit and complexity of the GWR model. It is given by the equation taken from Wheeler and Páez (2010, p.466):

$$AIC_c = 2n\log(\hat{\sigma}) + n\log(2\pi) + n\frac{(n + \text{trace}(H))}{n - 2 - \text{trace}(H)} \tag{8}$$

In this equation, $\hat{\sigma}$ represents the estimated standard deviation of the error in the GWR model. Larger estimation errors are penalized. The matrix H is the hat matrix, which is used to assess the influence of each observation on the model fit. The trace of H is the sum of its diagonal elements, which provides a measure of the model's complexity. The kernel bandwidth is used in the calculation of $\hat{\sigma}$ and H (Wheeler and Páez 2010, p.466). Specifically, for each row i of the hat matrix, the equation

$$H_i = X_i(X^T W_i X)^{-1} X^T W_i \tag{9}$$

is employed (Wheeler and Páez 2010, p.466). Note that the AICc value is utilized in both the neighborhood selection method and the estimation of the kernel bandwidth parameter.

For the neighborhood selection method, the AICc is used to determine the optimal neighborhood size. By comparing different neighborhood sizes and evaluating their corresponding AICc values, the method selects the neighborhood size that minimizes the AICc, indicating a better balance between model fit and complexity.

Regarding the estimation of the kernel bandwidth parameter, the AICc is employed as an objective function. The AICc is evaluated over a range of values for the kernel bandwidth parameter γ, and the value that minimizes the AICc is chosen as the estimated kernel bandwidth. This ensures that the selected kernel bandwidth parameter provides the best trade-off between model fit and complexity, as indicated by the minimum AICc value (ESRI 2023).

9.5 Bivariate correlations

Figure 19 gives an overview of the bivariate correlations of expellee inflows and employment share changes.

Figure 19: Bivariate correlations of expellee inflows and employment share changes

The graph depicting agricultural employment share changes shows a positive correlation with expellee share changes. Cities that experienced a higher expellee share change generally exhibited slight increases in their agricultural employment share, while cities with an outflow of expellees saw a decline in employment share changes within the agricultural sector. The correlation graphs for the mining, manufacturing, construction and transport sector employment shares show a decrease with an inflow of expellees. Conversely, the iron, trade and services sectors are associated with an employment share increase as expellees migrate to cities. However, note that only the iron, manufacturing and services sectors employment share changes show a statistically significant correlation with expellee inflows.

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