



Essays in Migration and Regional Trends in Germany

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Abstract

Germany is characterised by a remarkable history of labour migration, particularly since World War II. The country experiences regional economic disparities, manifested in varying income inequality levels, employment prospects, economic development and infrastructure. These regional differences and the existence of structural barriers shape the extent to which migrants integrate into society. This thesis explores the socio-economic disparities between migrants and natives at the regional level. Over the course of three essays, this thesis reveals a catch-up in socio-economic standing between migrants and natives, while also emphasising persistent regional disparities. Essay 1 explores the migration and inequality patterns in Germany from 1985 to 2015. Despite Germany's historical dependence on migrant workers, contemporary negative attitudes and bigotry often relegate migrants to lower social status. Examining representative German household (SOEP) and Platform X (Twitter) data, this chapter examines the inequality trends over a 30-year period (1985-2015). It evaluates the socio-economic achievements of migrants in education, occupation and income compared to natives. The results challenge existing public perceptions, as there is no empirical evidence to support the idea that the proportion of immigrants correlates with an increase in economic inequality.

Essay 2 examines household vulnerability, presenting a multivariate method that measures vulnerability as an underachievement of multidimensional well-being and explores its determinants. Using SOEP data spanning from 1985 to 2019, individual achievements in employment, health, and housing are examined and aggregated at the household level. The results show that non-native households exhibit the highest vulnerability, mixed households display the least vulnerability, and native households fall in between. Chapter 3 employs a task-based approach on German household data spanning 1985 to 2020. The study analyses discrepancies in occupational trajectories from a task-based perspective between the native and migrant populations at the aggregate and regional levels. The analysis draws upon convergence-type regressions to examine the aggregate and random coefficient models to explore the regional federal state levels, focusing on routine manual, routine cognitive, non-routine manual, and non-routine analytic tasks. The evidence suggests an aggregate-level convergence among native, foreign-born, and second-generation migrants, coupled with a narrowing gap between foreign-born and second-generation migrants. On the regional level, the findings indicate heterogeneity with a more subtle convergence observed in the East when compared with the West. The findings encourage ongoing efforts to further narrow the economic migrant-native divide. Addressing regional disparities requires collaborations between municipalities, non-profit and private sectors to exchange best practices and implement programmes that incentivize endeavours in disadvantaged regions (e.g., [MacKinnon et al. \(2024\)](#)). Additionally, inclusive workforce policies accelerating skill and degree recognition are vital to foster migrants' contributions to the German economy.


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I am eternally grateful to my parents and my family, for their encouragement, love, support and belief in my abilities that both inspired and enabled my academic pursuits.

Declaration

I hereby declare that the thesis is based on my original work, except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Brunel University or other institutions.

Name: Maria Popova Date: June 11, 2024 Signature: 

Supporting Publications

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Chapter 1

Introduction

Migration, a universal and compelling topic, poses formidable challenges for policy-makers and societies alike. In Germany the dialog surrounding migrants has evolved over time spanning multiple generations of impact. The origins of this discourse can be traced back to the 'guest worker' programme in the 1960s as a strategic response in the aftermath of World War II era to aid in the reconstruction of Germany, where a mainly low-skilled workforce (e.g., [Kring \(2021\)](#)) was hired to address the post-war labour shortage. Attracted by economic prospects, Germany has become substantially appealing for foreign workforce. The initiation of the guest worker programme not only addressed immediate economic needs but also paved the way for a complex and enduring debate about migration. Historically, German immigration policy, primarily shaped by economic needs and considered temporary until the 1970s, resulted in the absence of a national immigration policy until the late 90s. Until then the government viewed Germany as a regular non-immigrant country ([Franzke 2023](#)). In 2005, the implementation of the new Immigration Act (Zuwanderungsgesetz) marked Germany's declaration as an immigration country, establishing 'integration' as a legal obligation at both the state and municipal levels ([Filsinger 2018](#)). Over time, the enduring legacy of the initial waves of migrants following World War II, being predominantly comprised of low-skilled individuals, became ingrained in the collective consciousness) of the German society (see [Bourdieu \(1977a\)](#) for details on cultural reproduction). This has played a role in sustaining stereotypes and biases against migrants, steering the course of political decision-making and societal attitudes until today. These stereotypes, as emphasised by [Abramitzky and Boustan \(2022\)](#), include that migrants are often relegated to low social class and primarily work in low-wage sectors. The prevailing stigma and negative perceptions surrounding migrants extend beyond education, occupation, and income ([Davidov et al. 2020](#), [Heath et al. 2020](#)) to the point where increased inequality levels are often attributed to migrants. A common misconception regarding migrants is that migrants tend to remain in low socio-economic standings, do not climb the socio-economic ladder and consistently

fall behind the achievements of the native population. However, these assumptions often lack substantial empirical backing, with data gaps prevalent in many countries, including the United States (Abramitzky and Boustan 2022).

Advanced economies, such as Germany, largely rely on migrants, particularly considering the substantial shortage of skilled workers (Sauer and Wollmershäuser 2021, Peichl et al. 2022). Due to demographic changes and gaps in the labour market, the Germany economy substantially depends on migrants with diverse skill sets. This dependence extends from addressing the growing needs in the care sector (Blum et al. 2019) to innovative minds that drive the economy. In the history of migration in Germany, there are remarkable examples where migrants have been catalysts for innovation and change. Notably, the collaborative efforts of German-Turkish immunologist Dr. Ugur Sahin and Dr. Özlem Türeci, Chief Medical Officer of BioNTech, in developing the Pfizer-BioNTech COVID-19 vaccine underscore the influential role of highly skilled migrants in scientific progress. Similarly, the success story of Ijad Madisch, the founder of Research Gate born to Syrian parents who moved to Germany, exemplifies the entrepreneurial contributions made by migrants.

In light of the void of empirical support for prevailing migrant related narratives in this thesis, there is a pressing need for a thorough reevaluation and refinement of these narratives. The imperative for a change in perceptions and narratives goes beyond the acknowledgement and recognition of shortcomings but it indicates the compelling need for a societal paradigm shift. Acknowledging that the prevailing narratives surrounding migrants (e.g. Abramitzky and Boustan (2022)) are not substantiated by empirical evidence, it is essential to initiate a transcending discourse based on a more accurate understanding of the diverse contributions migrants make to the economy and the challenges inherent in migration. Embracing a more accurate comprehension of the various contributions made by migrants and the challenges they face, this paradigm shift becomes a collective endeavour to cultivate narratives that reflect the socio-economic surplus of migration, foster social cohesion and navigate the challenges with a shared societal commitment.

This thesis presents a comprehensive investigation of migration in the light of socio-economic inequalities on the regional level. Over the course of three essays, this thesis offers valuable insights into the entrenched narratives surrounding migrants, exploring and comparing trajectories in education, employment and income, as well as multidimensional vulnerabilities between natives and migrants. Notably, in the German context, the term 'migrant' includes foreign-born individuals as well as those with at least one parent born abroad.

Essay 1 examines the socio-economic standing of both natives and migrants and subsequently assesses the impact of migration-related socio-economic determinants, coupled with narrative sentiments on inequality patterns in Germany from 1985 to

2015. While Germany has a long history of relying on migrant workers, negative perceptions and stereotypes around migrants, which often relegates the latter to lower social status, persist. Through an analysis of representative German household survey and Platform X (Twitter) data, this essay uncovers the trends in inequality over a 30-year period (1985-2015) and assesses the socio-economic accomplishments of migrants in education, income and occupation compared to native counterparts. The findings challenge prevailing public assumptions, no empirical evidence supporting the notion that the proportion of immigrants correlates with a rise in economic inequality is found. Further, neither negative nor positive held public sentiments towards immigrants, reflecting society's socio-economic standing, appear to be linked to the increase in regional economic inequality levels.

Building upon Essay 1, Essay 2 focuses on the estimation of multidimensional household vulnerability. A multivariate method that quantifies vulnerability as underachievement of multidimensional well-being and examines its determinants is proposed. Drawing upon German SOEP data from 1985 to 2019, individual achievements in terms of employment, health, and housing are analysed and aggregated from the individual at the household level. The salient finding is that non-native households experience the highest vulnerability, mixed households demonstrate the least vulnerability, and native households fall in between. These findings add to the ongoing discourse on the vulnerability of migrants to experiencing poverty (e.g., Giesecke et al. (2017), Janßen and Bohr (2018)).

In the vein of Autor et al. (2003), essay 3 introduces a task-based approach applied to German household data spanning from 1985 to 2020. The study investigates occupational discrepancies between the native and migrant populations at the aggregate and regional levels. This exploration utilises convergence-type regressions at the aggregate and random coefficient models at the regional federal state level, focusing on routine manual, routine cognitive, non-routine manual, and non-routine analytic tasks. The results reveal an aggregate-level convergence among native, foreign-born, and second-generation migrants, along with a diminishing gap between foreign-born and second-generation migrants in Germany. Extending the analysis to the regional level, the findings uncover regional variations with less pronounced convergence observed in East Germany compared to the Western federal states.

Collectively, the three essays provide a comprehensive analysis of migration, inequality, and public narratives in Germany. Integrating different data sets and quantitative methods, this thesis offers valuable insights that question established beliefs and present new perspectives on the socio-economic standing of migrants. The findings contribute to the compelling public debate and suggest important policy implications, facilitating the development of more inclusive approaches to address economic inequalities, barriers to integration and promote the well-being of migrants

in Germany and beyond. Analogous challenges are faced across other industrialised countries, thereby rendering the conclusions drawn from this thesis not only relevant to Germany but these hold the potential to inspire positive global change, specifically in economies where migrants play a vital role in the labour force.

Chapter 2

Does Inequality Migrate? The Development of Income Inequality across German states

2.1 Introduction

Over the past few decades, economic inequality in Germany has been on the rise. The pace of migration has also picked up, prompting the question of whether these trends or concurrent phenomena are contributing to the widening gap between the rich and the poor. The public discourse around immigration is multifaceted and complex. This study set out to examine the evolution of public attitudes towards migrants, as well as the development patterns within the three pillars of the discourse: education, occupations, and income [inequality] in Germany between 1985-2015. While our study provides a thorough comprehension of the socioeconomic standing and contributions made by migrants in Germany, it primarily emphasizes a paradoxical and compelling observation that is supported both theoretically and empirically: public sentiments towards migrants show limited responsiveness to the real socio-economic impact of migrants in Germany- but this perspective requires reconsideration.

In accordance with predictions of Bourdieu's concept of cultural inheritance (reproduction) (Bourdieu 1977a, 1984), we observe that perceptions and attitudes towards migrants are deeply embedded into a society's cultural context, shaped by cultural markers such as historic experiences and memory which profoundly affect a culture's values, identities and collective beliefs inherited across generations. When the Gastarbeiter (guest workers) program was initiated as a temporary solution to address labor shortages following World War II, migrant workers were expected to return to their home countries once their contracts expired. The initial perception of temporariness influenced attitudes and policies, although some migrants chose

to stay in Germany, the legacy of the program's initial aim as a short-term remedy remained in the collective memory, contributing to the perception of migrants as "guests" or outsiders who were not originally meant to become a permanent integral part of society. Indeed, we identify a constancy of prevailing notions and attitudes toward migrants by conducting sentiment analysis on Twitter data spanning from 2007-2022. The analysis uncovers a consistent prevalence of negative sentiments towards migrants, significantly surpassing positive sentiments within the German-speaking community. In agreement with Bourdieu's view, the persistence in attitudes over time suggests that these are entrenched and passed across generations.

Contrary to the rooted views transferred from generation to generation, we present empirical evidence that goes against the prevailing narratives within the public discourse, particularly voiced by right-wing supporters. Such narratives have the vigor to magnify and reinforce public perceptions to the point that immigrants are viewed as mere guests in Germany, in its mass relegated to undesirable, low-income jobs, having limited educational and occupational prospects. However, we demonstrate that the negative beliefs and narratives propagated in right-wing public discourse, entrenched in historical notions (Semyonov and Gorodzeisky 2017), simply do not fit the data.

The empirical analysis provides insights into three dimensions of migrant's socioeconomic standing. First, we critically examine the belief that migrants have low educational levels, which underpins the constancy of negative attitudes. Second, we explore migrants' occupational prospects and third, we scrutinize migrants' income levels. Empirical findings, supported by convergence regressions, unveil a differentiated picture. We find that individuals with a migration background have narrowed the gap with the native population regarding income, educational attainment, and occupation, gradually catching up with their native counterparts. The proportion of migrants may even contribute to a reduction of inequality. This finding significantly challenges the prevailing narrative that immigrants inherently exacerbate educational, occupational, and income inequality. We show that fears and perceptions about immigration and inequality are not based on empirical evidence.

Germany is not alone in this context. In the United States, the notion of immigrant families and their children perpetually being relegated to a disadvantaged social class is disproved by evidence that dismisses such myths, the propagation of which may be linked to the growing polarization of narratives surrounding migration (Abramitzky and Boustan 2022). Shiller (2020) and Shiller (2017) emphasize that collective imagination (narratives) is crucial in shaping economic events, particularly during times of rapid change and crises. If such narratives dominate collective beliefs, it is essential to shed light on educational and occupational achievements among migrants and assess to which extent these de facto shape regional income inequality in Germany,

paving the way to constructive dialogue that can increase the sense of justice and cease undermining social togetherness.

From a historical viewpoint, Germany emerged as an attractive destination for immigrants due to its well-established social security system. Today, migrants and their descendants from significant immigration waves¹ have become an indispensable element of German society and have made substantial contributions to the country's prosperity (e.g., [Clemens and Hart 2018](#)) and its capacity to respond to evolving economic, demographic and social challenges (e.g., [Kahanec and Zimmermann 2009b](#)). Given demographic shifts and labor market gaps, Germany's economy heavily relies on migrants across skill levels, from low-skilled workers in sectors like hospitality to high-skilled innovators enhancing economic competitiveness. For example, the development of the Pfizer-BioNTech COVID-19 vaccine, led by German-Turkish immunologist Dr. Ugur Sahin and German physician and entrepreneur of Turkish descent Dr. Özlem Türeci, the Chief Medical Officer of BioNTech, showcases the role of high-skilled migrants in scientific advancement.

Data for this study were collected from the German representative longitudinal panel carried out annually (SOEP), covering 1985-2015, recompiled on a federal- state level. Considering the regional perspective, we document a rise in economic inequality at the federal and state levels. Further, we find that that East Germany accommodates fewer migrants, however, these are more likely to be highly qualified compared to immigrants domiciled across other federal states. Overall, this study critically reevaluates the prevailing narrative concerning migration and inequalities in Germany, showcasing that public opinion about the role of migrants in society should be formed by migrants' real socio-economic impact rather than by the portrayal of migrants based on generational memory or social inheritance.

The rest of the chapter is structured as follows: Section 4.2 reviews related literature, Section 4.3 describes the data and the empirical model. Section 4.5 presents the empirical results. In Section 2.4.1 we analyze migration-related attitudes using migration-targeted sentiment data based on textual analysis sourced from Twitter. The analysis of the evolution of inequality across German federal states is presented in Section 2.4.2. Section 2.4.3 discusses educational achievements and Sections 2.4.3 and 2.4.3 examine the position of migrants and natives across the income and occupational distribution. Section 2.4.4 presents results of the regression analysis of income inequality. Sections 2.5 and 3.7 discuss and conclude the results in light of a wider migration and inequality debate.

¹ Followed by a migration wave of German expellees and resettlers between 1945-1949 and the economic miracle during the 1950s, Germany actively recruited a workforce, the so-called "guest workers" from Southern Europe, Turkey, and former Yugoslavia to cover labor shortages to ensure and support the country's post-war flourishing economy.

2.2 Literature Review

Before discussing the empirical evidence on the intricate relationship between income inequality, socio-economic dimensions of migrants, and narrative migrant sentiments in Germany, which reflect the socio-economic landscape, we conduct a thorough review of the existing literature and findings on migrants' incomes, educational attainments, and narrative sentiments. In addition, we embed these findings within Bourdieu's theoretical framework, which provides valuable insights into the socio-economic phenomena observed in the context of migration in Germany.

2.2.1 Income of migrants

In pursuit of understanding economic equity, social cohesion, and the overall welfare of both the native and migrant populations, the academic discourse has thoroughly explored the integration of migrants into labor markets. Since income serves as a critical indicator of economic integration, this section reviews the existing literature on the native-immigrant wage disparities in Germany.

A large body of literature on wage differentials between natives and migrants in Germany (for example, [Pischke 1992](#), [Schmidt 1997](#), [Aldashev et al. 2012](#)), consistently highlights that following the first few years upon arrival, migrants earn considerably less compared to their German counterparts, but with duration of stay wages converge ([Romiti et al. 2015](#), [Lehmer and Ludsteck 2015](#)). This aligns with the findings of the study by [Bossler \(2014\)](#), which reveals that more recent migrants in Germany, as opposed to those with over two decades of residency, are more likely to occupy lower-paid positions. Several factors contribute to this substantial wage disparity among recent immigrants, including sorting mechanisms ([Granato and Kalter 2001](#)) that allocate them to specific workplaces and job roles, limited representation in higher-paying jobs, restricted career development prospects, and instances of discriminatory practices within the labor market. Another factor is that immigrants often accept lower reservation wages ([Nanos and Schluter 2014](#)). Over time, observable characteristics, such as education, work experience, and regional location ([Brunow and Jost 2020](#)) collectively contribute to the substantial wage disparity observed between recent immigrants and those who have resided in Germany for an extended period.

[Brücker et al. \(2021\)](#) and [Basilio et al. \(2017\)](#) document that foreign-acquired educational qualifications and work experience hold lower value compared to domestic qualifications. This discrepancy helps explain the earnings disadvantages faced by immigrants, supporting similar findings in the international literature (e.g., [Friedberg 2000](#), [Hajro et al. 2019](#)).

Starting from 2010 skilled immigration from third countries has significantly contributed to addressing the shortage of professionals across various academic disciplines/fields. When exploring the wage profiles of immigrants in Germany, [Zibrowius \(2012\)](#), raises a fundamental question, exploring whether wages between natives and immigrants diverge or converge over time. The findings reveal that immigrants in Germany, with the exception of those in the low and partially medium-skill group, face challenges in achieving wage parity with native Germans, even when accounting for both work experience and years since migration. Notably, the study suggests that in particular highly skilled immigrants face significant earnings disadvantages, prompting concerns about whether native Germans enjoy cumulative advantages and the existence of possible discrimination in terms of job opportunities. This finding is particularly concerning since highly skilled immigrants are in great demand within the German labor market. Examining the second generation of migrants, a recent study by [Stockhausen \(2022\)](#) found that migration background has a marginal influence on incomes in Germany.

In sum, the wage disparities between migrants and Germans diminish substantially with the increasing duration of stay, accumulation of work experience, and the attainment of additional education and training. Our empirical results show a convergence in both educational attainment and subsequently incomes between the native and immigrant population in Germany. This convergence exhibits the accumulation and adaptation of cultural and social capital by means of education and socialization among immigrants over time. While migrants are expected to possess lower cultural capital endowment ([Bourdieu 1977b](#)) they are not necessarily permanently relegated to lower social class. Access to education and occupational opportunities facilitates the accumulation of cultural capital among migrants to improve their positioning and climb the socio-economic ladder.

2.2.2 Education of migrants

A lot of attention on educational attainments and economic outcomes of migrants in Germany deals with the question of social mobility and assimilation across generations ([Riphahn 2003](#), [Fick 2011](#), [Gries et al. 2022](#)).

Previous research yields a mixed picture regarding the educational assimilation of immigrants in Germany. Aligning with Bourdieu's theoretical expectations, migrants frequently face discrimination. This observation underscores the existence of a discriminatory mechanism that perpetuates the societal class structure, a phenomenon well-documented in studies conducted across multiple countries (e.g., [Levels et al. \(2008\)](#), [Tubadji et al. \(2017\)](#)). For Germany, [Riphahn \(2003\)](#) examined the educational attainments of German-born migrant children and found that their educational per-

formance falls behind that of natives, suggesting the persistence of substantial educational disparities. This view is supported by [Kristen and Granato \(2007\)](#), stating that primarily Turkish and Italian second-generation descendants are significantly burdened compared to natives. Contrasting the educational success of the foreign-born, second-generation migrants and natives, [Algan et al. \(2010\)](#) find significant differences between former *guest workers* and the natives in addition to the overall observed educational lag between the foreign-born and natives. Further, [Algan et al. \(2010\)](#) argue for a diminishing educational gap between second-generation migrants and Germans, however a persistent gap for Turkish, Yugoslavian, and Italian descendants is observed. These findings are confirmed by [Gries et al. \(2022\)](#), identifying that immigrants with ethnic backgrounds closer to German culture and language presumably demonstrate better educational achievements. Previous research links lower socio-economic positions to lower academic achievements and vice versa ([Chetty et al. 2011](#), [Aikens and Barbarin 2008](#)). Adopting a broader perspective, [Alba et al. \(2017\)](#) points to the importance of parental socio-economic status for academic success in Germany and argues in favor of an educational convergence between native Germans and second-generation migrants. We provide empirical evidence in support of educational convergence suggested by [Alba et al. \(2017\)](#). In light of the literature, an intriguing observation in the German context is that cultural factors, possibly influenced by a local appreciation for objective merit in scientific fields, have rendered discrimination less visible in the realm of educational recognition. Nevertheless, we show that discrimination persists as an overarching societal perception within the local context, which serves as compelling evidence for the concept of cultural relativity ([Tubadji 2020](#)), illustrating how cultural perspectives and norms influence the visibility and interpretation of discrimination in diverse regional settings.

2.2.3 Sentiments toward migrants

To understand the constancy of attitudes towards migrants in Germany, we explore the concept of cultural attitude transmission as a critical perspective through which to immerse in Bourdieu's theoretical framework on cultural reproduction ([Bourdieu 1977a](#)). In Bourdieu's theory, cultural markers represent the enduring beliefs, norms, and values characterizing a particular culture or social group (for more information see, for example, [McElreath et al. \(2003\)](#)). Further, these shape individuals' perceptions, preferences, and behaviors. Although migrants in Germany have experienced improvements in education, occupation, and increasing income levels, these cultural markers continue to have a significant lasting impact on how native Germans perceive and interact with migrants. Consequently, these cultural markers persistently shape attitudes toward migrants, rendering attitudes unaffected by migrants' actual socio-

economic progress. One intriguing and concerning cultural marker in this context is the historic memory, which sheds light on the reason why the native population, even in the face of evidence highlighting migrants' advancements in socio-economic status, does not change their attitudes towards migrants.

Throughout its history, Germany has witnessed several migration waves, including the guest worker program, where primarily low-skilled laborers were recruited to fill the post-war labor shortage. Over time, collective historical memory of these earlier migrant waves, being predominately low-skilled and destitute, became entrenched in society's consciousness, to the point that this contributed to the persistence of stereotypes and biases against migrants that influence contemporary perceptions. As outlined by [Abramitzky and Boustan \(2022\)](#), these stereotypes include presumptions that migrants are often confined to low social class or predominantly engage in low-paid jobs.

While Bourdieu's concept of cultural transmission of attitudes provides a valuable framework for understanding the persistence of attitudes toward migrants in Germany, we now aim to bridge this theoretical foundation with current research focusing on migrant narrative sentiments. We first attend to the literature on drivers of unfavorable attitudes towards migrants (e.g., [Davidov et al. 2020](#), [Hainmueller and Hopkins 2015](#), [Scheve and Slaughter 2001](#)).

Firstly, studies identified that increased integration, (e.g., [Chiswick and Miller 2012, 2002](#)) is likely to lead to better employment perspectives and societal participation and thus may reduce negative attitudes towards migrants. Secondly, an adverse public reaction can be triggered if migrants are perceived as competitors ([Scheepers et al. 2002](#), [LeVine and Campbell 1972](#)). These studies imply that attitudes are largely shaped by a combination of political, cultural, and economic factors including perceptions about job competition, cultural discrepancies, and perceived threats to national identity. Moreover, it is suggested that attitudes towards distinct migrant groups differ and media exposure to or personal interaction with migrants strongly shapes the public's attitudes towards the latter. As outlined by [Alesina et al. \(2023\)](#), [Gorodzeisky and Semyonov \(2020\)](#) and [Grigorieff et al. \(2020\)](#), misinformation on migrant demographics may drive the public's opinion on migration.

A number of theories have been proposed to explain the rise in anti-migrant attitudes. Pioneered by [Quillian \(1995\)](#) status competition theory, anti-immigrant attitudes occur due to increased status competition as a result of a substantial proportion of migrants or an increase in the migrant population. Another theoretical strand builds on the group conflict theory and the ethnic competition theory ([Tolsma et al. 2008](#), [Scheepers et al. 2002](#), [LeVine and Campbell 1972](#)), this theoretical framework assumes that hostility and discrediting attitudes result from competition between the native and immigrant groups over sparse resources. [Katz and Taylor \(1988\)](#), identi-

fied perceived threat as the salient motive of disapproving views towards minorities. In contrast to [Haaland and Roth \(2020\)](#) who study attitudes towards migrants in the light of labor market concerns, [Stawarz and Müller \(2020\)](#) do not find a significant effect of unemployment concerns on the rise of negative attitudes, instead, the authors suggest that subjective fears, such as crime being rather evocative, are more likely to shape the public's attitude towards migrants as opposed to economic concerns. In sum, research exploring the role of information provision and media parlance on attitudes finds that exposure to content providing political context and personal immigrant narrative can lead to more positive attitudes toward foreigners and increase empathy. Conversely, exposure to political messages portraying foreigners as a drain on resources and a threat to social cohesion and national security tends to result in rather negative public opinions. Overall, these studies accentuate that caution needs to be exercised while interpreting the obtained empirical evidence as the latter might substantially vary subject to the socio-political climate and sentiments within German society.

2.3 Data

In this section, we briefly describe the data set and variables that are used in the empirical analysis to construct immigration-related measures of income inequality in Germany

2.3.1 GSOEP

The data used in the analysis of immigration-related parameters and its impact on economic inequality falls into two categories. First, we use the GSOEP ² household-level dataset (version 35) which provides both household and individual-level data on personal characteristics, education, living arrangements, financial position, wages, employment status, migratory as well as occupational history to obtain economic and demographic control variables as well as household level income data to obtain the dependent variable, measuring economic inequality. Our analysis considers the data covering the period 1985-2015.

The dependent variable, *income inequality*, is constructed and recompiled on a federal state level in accordance with the definition of the World Bank and current literature based on household post-government income. Popular measures of inequality are the Gini coefficient (e.g., [Medeiros et al. 2022](#), [Farber et al. 2021](#), [Mijs 2019](#)) and

² The German Socio-Economic Panel (SOEP) is a longitudinal panel dataset and one of the largest and longest-running multidisciplinary household surveys conducted since 1985. Yearly, approximately 30,000 individuals in 15,000 households are interviewed. Version: ([SOEP 2019](#)).

decile ratios such as the Palma ratio (90/40) (Palma 2011), to estimate the income earned by the richest 10% of the income distribution relative to that of the poorest 40%. Considering the entire distribution, the Gini coefficient is more sensitive to changes in the mean of the distribution and less sensitive to changes at the tails of the income distribution where most poverty and wealth accumulation is witnessed. In our baseline regression, we use the Gini coefficient to quantify income inequality. We assess the robustness of our findings by also considering the Palma ratio, as it is more sensitive to changes in the top 10 of the income distribution relative to those allocated at the bottom 40 percent.

With regards to the immigrant status, the GSOEP distinguishes between a direct and indirect migration background, where 'direct' indicates that the individual immigrated by him/herself and 'indirect' refers to an individual who is of migrant origin (at least one parent is foreign-born) but born in Germany. The value of the underlying variable coded 'no migration background' refers to individuals born in Germany holding German nationality whose parental information is non-available, which likely leads to distorted 'indirect migration background' responses. In the following sections, our descriptive analysis accounts for the native, foreign-born, and second-generation migrant populations - hereafter referred to as sub-groups.

To control for rising income inequality levels, the following parameters, based on the foreign-born population in Germany have been included as control variables: the percentage of total labor income earned by the top and bottom 10% of the foreign-born population, the share of the foreign-born population per federal state, the percentage of highly and poorly educated foreign-born as well as the percent of GDP by the federal state. To obtain these parameters on a federal-state level, all individual-level panel data between 1985-2015 ($N= 2,951,438$) was cleaned and recompiled to the federal state level (16 states), leaving us with 16 observations per control variable annually. Note that before 1992, the data was not available for 5 federal states that were in GDR before reunification. The data was also not available for the federal state of Saarland until 2001. Therefore, the observations (T) for each federal state ($N = 16$) range between 14 to 25 for the period covering 1985-2015, amounting to $\sum_i T_i$ (or NT) = 372 observations included in the empirical model. To assess educational accomplishments among the native and foreign-born population, consistent with the 'Comparative Analysis of Social Mobility in Industrial Nations (CASMIN)'³,

³ The education classification system makes a distinction within the hierarchy of educational levels, subject to length and level of educational experiences as well as the required intellectual abilities and the value of the degree obtained (Müller et al. 1989, Müller and Michael 1997, Brauns and Steinmann 1999). It also takes into account the international comparability of educational qualifications. We use the underlying classification to code educational attainments of the foreign-born population within the sample into 'low', 'medium' and 'high', guided by previous studies (Moor et al. 2018,

individuals holding low or high tertiary degrees are assigned to 'high', those holding intermediate qualifications (e.g. general qualification, intermediate vocational, general maturity certificate, vocational maturity certificate) are coded as 'medium'. We classify individuals who neither completed elementary education nor basic vocational qualification as 'low'. Due to multicollinearity issues, we solely consider low and high educational levels. The descriptive statistics are discussed in the empirical section 4.5.

2.3.2 Twitter

In addition to using panel data from the GSOEP, we also retrieve Twitter data related to immigration (which has been available since 2007) and employ quantitative opinion-mining techniques to examine public narratives surrounding migrants within the German-speaking community.

We use these data to better understand the public attitude towards migrants in the German-speaking community. Tweets have been filtered by at least one of the following German migrant-related words: *Migranten*, *Ausländer*, *Einwanderung*, *Einwanderer*, *Zuwanderer*, *Migrantinnen*, *Flüchtling*, excluding re-tweets. Based on our search query, we collected 50,000 Tweets in the German language per year from 2007 till mid-2022 in order to perform the sentiment analysis by means of natural language processing techniques. Once the data was extracted a sentiment analysis which aims to quantify the perception (polarity) of a text was carried out. The analysis reveals whether the text is perceived as positive or negative, hence we aim to identify the polarity of immigrant-related public sentiments among German speakers. We do not limit our Twitter data analysis to Germany in geographic terms but to the language, since we assume that a German language Tweet largely affects the German-speaking community and consequently the public discourse regardless of the particular user location.

We are applying a lexicon-based approach to compute the polarity of the collected Twitter data. The sentiment analysis is based on the publicly available German language text-mining lexicon *SentiWS* (SentimentWortschatz) (Remus et al. 2010). We apply the latest available version (v2.0), the compound of 16,000 positive and 18,000 negative word forms including their inflections, classified to positive/negative polarity connoted words, weighted/stored within the interval of [-1; 1]. *Positive* and *Negative* polarity come in separate packages, provided by the University of Leipzig, which are combined and rearranged. Our text mining analysis closely follows Wickham (2014) and Silge and Robinson (2017).

Before assigning sentiments to tweets, data were pre-processed and transformed into a tidy text format. Prior to transforming the data to a tidy-text format, stop

Schröder et al. 2020).

words, and special characters that do not convey any content and are thus deemed obsolete are removed from the data by applying two German stop word packages in R. The tidy-text format is achieved by means of tokenizing, which is dividing the tweet text into tokens. This results in a table containing a single word per row using the `tidytext` package. In the next step, the sentiment score and polarity are assigned to the tokenized text using the lexical resource (SentiWS). Words for which no sentiment is available have been removed.

Following the lexicon-based sentiment analysis, the annual sentiment score is computed drawing upon complied polarity scores. We first considered the median of all positive and negative scores collectively. While splitting the sentiments and generating separate scores (positive and negative respectively), negative sentiments appeared to have a substantially higher magnitude compared to positive ones for the entire period 2007-2022. Hence instead of using the median or arithmetic average of the sum of negative and positive sentiments which will draw out and allay the severity of negativity conveying language, we compute the sentiment scores separately in two ways: estimating the median in a first step and the most *negative* (considering the 10th percentile) and most *positive* (90th percentile) sentiment in a subsequent step. The sentiment scores are discussed and visualized in Section 2.4.1. Positive, negative, and the sum of sentiments are included in our extended empirical model to collectively test the impact of migrant-related public sentiment and immigrant determinants on income inequality.

Studies conducting demographic research using non-representative data, point to some of its limitations and caution that needs to be exercised with regard to estimation errors and biases inherent in data retrieved from social media (Yildiz et al. 2017). Since the provision of residential location and personal data is a matter of choice and Twitter does not reveal the IP addresses of its account holders, demographic details of Twitter account holders, such as gender and age are sporadically available. Although we acknowledge these limitations, we believe that the findings obtained from this data are still valuable and offer insightful perspectives.

2.4 Empirical Results

In this section, we provide evidence for the constancy of sentiments towards migrants, the evolution of regional inequality in Germany as well as migration-related trends. First, Section 2.4.1 analyzes migration-related measures using sentiment data based on textual analysis of tweets from Twitter. Section 2.4.2 discusses the evolution of inequality across German federal states. Section 2.4.3 discusses educational achievements and 2.4.3 and 2.4.3 examine the position of migrants and natives across

the income and occupational distribution. Section 2.4.4 performs regression analysis of income inequality and migration.

2.4.1 Sentiment toward migrants in the public discourse

In line with Bourdieu's theory expectation, migrants are generally found to be discriminated as documented on numerous occasions for other countries, for example in the Netherlands, Tubadji et al. (2017) documents that individuals with a migration background experience labor market disadvantages stemming from lower attendance rates at high-quality educational institutions, while also noting that graduates from second-generation migrant backgrounds face similar disadvantages due to limited access to higher-quality education. In the European context considerable amount of research has been devoted to the public sentiments towards migrants, providing insights on the prevalence of normative perceptions, preferences on immigration policies, and evidence for the regional divergence of attitudes (Davidov et al. 2020, Heath et al. 2020, Helbling and Kriesi 2014, Zick et al. 2011). These studies focus on a range of aspects related to the evolution of public attitudes towards migrants, such as perceived threat, the role of identity, along with the willingness to contribute to social integration and participation of migrants. Following Bourdieu (1977b), cultural capital in the form of cultural knowledge, skills, education, and attitudes that individuals acquire through their socialization (upbringing, education, and social experiences) is vital in shaping various aspects of an individual's life, including their attitudes and sentiments. As proposed by Bourdieu the channels of impact associated with cultural capital are deeply rooted in the transmission of cultural attitudes, largely stemming from participation in various cultural activities and cultural consumption. Due to their exposure to different cultures, cosmopolitan experience (art, literature, languages) and education, individuals with a higher endowment of cultural capital, are more likely to hold positive and more inclusive attitudes toward migrants. Positive attitudes can result in better integration of migrants into host societies, reduce discriminatory practices, and hence diminish levels of inequality. As opposed to that, individuals exhibiting low levels of cultural capital tend to hold rather negative and stereotyping attitudes, which may result in policies perpetuating inequality and exclusionary conduct. In sum, a significant accumulation of cultural capital endowment within society is associated with the cultivation of positive attitudes, which can lead to a reduction of barriers (Damelang and Haas 2012) and economic inequality. Consequently, in such a society, migrants face fewer hindrances to their socio-economic progress as opposed to being confined to low socio-economic contexts, discrimination, and challenges impeding economic advancement. For the observed period, Germany has not implemented any migration policy that restricts migration based on

specific skills, hence with no barriers to socio-economic advancement, just like the native population, migrants can be found across the entire educational, occupational, and income distribution. Conversely, in societies where lower levels of cultural capital prevail, there will be a higher prevalence of negative perceptions, that amplify inequality by perpetuating barriers and challenges to the socio-economic progress of migrants. Based on the analysis starting with Twitter data since 2007, our estimation reveals that there is a higher proportion of negatively connoted words in contrast to positive ones. In addition, Figure 2.1 highlights, the frequent use of *illegale* (illegal) and *kriminelle* (criminal) in the migration-related context of tweets. The word-cloud in Figure 2.1 illustrates the polarity of the most frequent words (as shown in Appendix A Figure 5.2) associated with migration in the German language context.

FIGURE 2.1 here

Rather than estimating the median sentiment, which may mask the severity of the positive/negative sentiment, we calculated sentiments separately by their polarity. Firstly, by estimating the median of the positive/negative sentiment respectively, and secondly by estimating the most negative (considering the 10th percentile) and the most positive (90th percentile) sentiments. Figure 2.2 and Figure 2.3 visualize both approaches.

FIGURE 2.2 here

FIGURE 2.3 here

Figure 2.2 compares the evolution of the median positive and negative sentiment since 2007. Closer inspection shows that both positive and negative sentiments remained relatively stable in the years following 2010, while an initial marginal increase in positive sentiment and a decrease in negative sentiment is observed. In sum, however, the magnitude of negative sentiments exceeds that of positive sentiments. Although, as illustrated in Figure 2.3, the most negative sentiments have dropped somewhat, they still outnumber the positive sentiments. Despite the possibility of a perceived association between rising economic inequality and migrant-targeted sentiments, the presented evidence reveals no discernible impact of the latter.

2.4.2 The rise of regional inequality in Germany

Figure 2.4 and Figure 2.5 show the evolution of the Gini coefficient over time by federal states. In Figure 2.4 the last three decades were split into six roughly equal sub-periods for simplicity to visualize the inequality dynamics following the reunification of Germany (1990). Bleaker color in Figure 2.4 implies less inequality, and

more intensive color implies more inequality.⁴ It is easy to observe an overall increase in income inequality for the estimated period. Following the reunification income inequality in the new states (East Germany) was relatively low, however, a gradual increase in income inequality was noted starting in about 2000. Figure 2.6 highlights the regional income inequality dynamics between East and West Germany. A sharp rise in income inequality was recorded in both regions around 2001, however, income inequality in West Germany exceeds the rates observed in the East. Hence, there have been regional variations in the evolution and rate at which income inequality accelerates across the states, and by approximately 2005 we observe a trend towards higher levels of inequality in Brandenburg among the new states. At the same time, the highest level of inequality is witnessed in the north, Schleswig-Holstein and Bremen, between 2006 and 2010. Still, income inequality in Bremen remains comparably highest,⁵ while in the following period, income inequality in Lower Saxony and Baden-Württemberg fell, it remained stable at a relatively high level in Hesse and North Rhine-Westphalia.

FIGURE 2.4 here

FIGURE 2.5 here

FIGURE 2.6 here

From a theoretical standpoint, the observed variations in income inequality levels in Germany as outlined above are closely tied to disparities in human capital productivity and its spatial distribution. Regions with a more productive workforce experience greater economic growth, while those with lower human capital face economic challenges. Hence, human capital distribution is closely related to regional development and perpetual spatial economic inequalities (Dickey 2014), which underscores the key role of equitable access to education and skill development to alleviate these disparities. Williams (2009) suggests that migration can lead to uneven regional development, benefiting some regions while weakening others through brain drain and

⁴ Note that before 1992, the data was not available for 5 federal states that were in GDR before reunification. The data was also not available for the federal state of Saarland until 2001. Therefore, the observations (T) for each federal state ($N = 16$) range between 14 to 25 for the period covering 1985–2015, amounting to $\sum_i T_i$ (or NT) = 372 observations included in the empirical model.

⁵ In the midst of the global economic slowdown in the 1970s, the manufacturing industry in Bremen was severely affected. Two major shipbuilding firms which attracted thousands of guest workers, went bankrupt in the 1980s and 1990s, forcing numerous companies to close down which led to excessive unemployment rates over the past decades. According to the Federal Statistical Office, the unemployment rate is around 10% which is the highest recorded in Germany. Today, income inequality is high, in the borough Bremen Gröplingen the taxable annual income amounts to 17,600 EUR, in Horn, a district in the east of Bremen, it is 144,900 EUR.

social exclusion. Valuable insights into the impact of migration on human capital distribution and regional development, enhancing our understanding of the observed income inequality dynamics in Germany are provided in the work by [Tubadji and Nijkamp \(2015\)](#).

Through the lens of Bourdieu, [Tubadji et al. \(2022\)](#) extends on the discussion on migrants' impact on income inequality, introducing the 'Bourdieu Effect' which explores the relationship between local cultural capital and regional income inequality within the framework of culture-based development ([Tubadji and Pelzel 2015](#)).⁶ Accounting for the reciprocity between cultural, social, and human capital across Italian regions [Tubadji et al. \(2022\)](#) provides evidence for a strong culture-driven Bourdieu effect, suggesting that culture as reflected by cultural capital has a substantial effect on regional income inequality. Additionally, cultural capital is identified to compromise both living cultures, such as contemporary cultural practices, and cultural heritage. This implies that the coexistence of geographical concentration of human capital (for instance, in the form of knowledge and skills) combined with cultural heritage alone can not reduce regional income inequality. To address regional economic disparities, in addition to human capital and cultural heritage a region needs commitment to redistributive policies and a strong 'living culture'.

2.4.3 Catch-up and spatial patterns

Here, we present empirical evidence on the development of educational, occupational, and income components of migrants' presence in German society. The purpose of this section is to show how the gap between the natives and migrants has narrowed over time.

Educational Attainment

Table 2.1 compares the educational attainment of the native and foreign-born population between 1985 and 2015 using the CASMIN classification. The share of foreign-born holding tertiary ('high') educational qualifications is gradually increasing. By 2015, 25% of the foreign-born population are degree educated which is equivalent to the proportion among natives, 24.72%. The results of the chi-square test confirm that there was no significant difference in the proportion of highly educated individuals among the foreign-born and natives respectively (the p -value of the null hypothesis that the proportion among natives and foreign-born is the same is equal to 0.3892). The desire to attain higher educational levels can be rationalized by economic, societal, and personal factors. Increased educational attainments of migrants in Germany

⁶ For a comprehensive analysis of culture-based development in Germany see [Tubadji \(2012\)](#).

can be viewed as a possibility of social mobility (Fick 2011). Evidence provided in Table 2.1 and Figure 2.7 (the two upper and the bottom-left panels) illustrate a clear trend of enhanced educational accomplishments among the foreign-born population. The bottom-right panel of Figure 2.7 presents the relative difference in proportions between natives and foreign-born indicating catch-up in terms of education. Additionally, around one-third (31.39%, 2015) of migrants have accomplished general to high vocational training. In essence, the comparison highlights that migrants' educational attainments are converging to the levels witnessed among natives.

TABLE 2.1 here

FIGURE 2.7 here

To reinforce and formalize the evidence provided by the bottom-right panel of Figure 2.7, Figure 2.8 plots the difference in proportions between natives and foreign-born against the proportion among migrants for the three educational levels (high, medium, low). Akin to the economic growth convergence approach, the negative relationship would indicate a catch-up of migrants to their native counterparts. All three scatter plots indicate a downward relationship. The smaller the proportion of migrants with a specific educational level, the larger the difference between natives and migrants. As the proportion of migrants with that level of education increases, the difference in education levels compared to the natives decreases, pointing to the catch-up tendency. Figure 2.8 also plots the 95% confidence intervals of the convergence regression. The coefficient for 'high' education is negative (-0.2426) and statistically significant ($p - value < .001$), indicating that there is a convergence of high educational levels. Further, the model yields a negative and statistically significant coefficient (-0.21727), ($p - value < .01$) for 'medium' educational levels, and a negative statistically significant coefficient for 'low' educational level (-0.18941), ($p - value < .001$).

FIGURE 2.8 here

Although, scholars have documented that educational qualification and labor market experience obtained in the source country are substantially less valued compared to education and professional experience acquired in the recipient country (see e.g., Brücker et al. 2021, for discussion of the German context), explaining earning disadvantages faced by immigrants (e.g., Hajro et al. 2019, Mattoo et al. 2008, Friedberg 2000), our findings imply that migrants' educational attainments are converging to educational levels of native Germans.

Our findings initially reveal that significant disparities in educational qualifications between migrants and native Germans persisted until the late 1990s. This observation aligns with Bourdieu's theory, by which migrants are expected to have lower

cultural capital compared to natives due to limited access to educational resources, linguistic barriers, and unfamiliarity with the host society's cultural norms. These challenges often result in migrants entering the host country's educational system with deficient cultural capital, potentially leading to lower educational attainment. However, the subsequent figures (Figure 2.7 and Figure 2.8), along with the convergence regression estimates, point to a narrowing gap in tertiary qualifications by 2015 - thus contradicting Bourdieu's viewpoint. The evidence revealing a narrowing native-immigrant gap in terms of educational achievements can be ascribed to a couple of critical factors, first the generational impact and second, enhanced access to information and resources. Across decades since the guest worker program, subsequent migrant generations have progressively adapted to the cultural conventions, the language, and the educational system. Within the migrant population, this has acted as a catalyst for improved educational attainments, facilitating the alignment with German educational conventions. In addition, improved access to resources and information has been pivotal for educational convergence. Particularly through existing social ethnic networks (Williams 2009, Heider et al. 2020) and enhanced information accessibility, migrants have gained valuable insights into educational opportunities and available support. Collectively, these aspects lead to the empowerment of migrant generations to efficiently navigate the educational landscape resulting in diminishing disparities across educational levels by 2015. In summary, the challenge to Bourdieu's theory in the context of Germany is a result of a complex interplay of regional peculiarities, including policies, access to resources, and generational changes. In Germany, various measures have been implemented to promote the integration and advancement of migrants. These measures span across various educational levels, from early childhood to higher education, and encompass initiatives such as bilingual early childhood programs, integration-focused language courses, specialized programs for migrant women, support for prospective students, as well as a diverse range of efforts to ease entry into the labor market, vocational training, and career progression.

Employment

Since there is regional heterogeneity of industrial sites and locations in Germany, the policy is implemented on the aggregate level. Hence, we account for 34 different employing industries (2-digit industry code) provided by the individual-level panel data and aggregate it to the country level. For simplicity and clarity, we categorize the industries according to the original definition of the three-economic-sector model whereby economic sectors are classified as primary, secondary, and tertiary (Clark 1957, Fourastié 1949, Fischer 1939). The primary sector includes the extraction of raw

materials, the secondary deals with the processing and manufacturing of these, and finally, the tertiary sector includes all kinds of services. Employment in any of the 34 industries will fall into one of these categories. Figure 2.9 shows the proportions of employment in the three sectors by migration status. When we consider migrants' occupational distribution, both natives and migrants largely benefited from the educational expansion experienced in the 1960s. For migrants in particular, education is an important resource for improving their employability and thus socio-economic position. Although migrants were substantially present in low-skill industrial work in Germany throughout the past decades (see e.g., Krings 2021), Figure 2.9 shows that employment across sectors between the native population and migrants became more homogeneous. For policy implications, it is useful to analyze the potential convergence/divergence of occupational achievements among migrants and natives over time. By examining the trends in the occupational accomplishments of migrants and natives, policymakers can identify potential barriers to integration, assess the effectiveness of integration policies and adjust policies to foster immigrant labor market integration.

FIGURE 2.9 here

While between 1985 and 1991 51% of natives and 73% of foreign-born were employed in processing and manufacturing industries and 6% of natives in the primary sectors, in the early 2000s only 3% of natives and 2% of foreign-born were still working in the primary sector. During the periods following the new century, the proportion of those working in the primary sector remained relatively stable. The shifts from the primary and secondary sectors towards the tertiary sector are non-negligible. Overall, the estimations reveal that foreign-born individuals and notably second-generation migrants do not lag behind the native workforce in terms of occupation and education. The differences between sectoral employment of natives and foreign-born individuals, considering moving averages over 1985-2015 are highlighted in Figure 2.10.

FIGURE 2.10 here

What stands out in Figure 2.10 is the convergence trend of the two groups in the secondary and tertiary sectors. The relative difference between native and foreign labour force participation in primary sector employment fluctuates due to various factors, including labour market integration and political decisions regarding work permits and restrictions. Although the service sector has become the largest employer in Germany, causing a gradual shift away from the primary sector, employment in the primary sector has remained virtually constant over time. The transition from the primary and secondary sector, heavily relying on manual routine work towards rather

non-routine cognitive service-based occupations (tertiary sector) highlights educational upward mobility applying to both migrants and natives. Figure 2.11 displays the convergence type analysis similar to that of Figure 2.8. Figure 2.11 illustrates the narrowing divide in sectoral occupation between migrants and natives based on convergence regression models. The relationship is negative and significant for the tertiary and secondary sectors. The coefficients are equal to -0.45 ($p - value < .001$) and -0.49 ($p - value < .001$). This implies occupational convergence in these sectors between the migrant and native populations. The results for the primary sector occupation go in the opposite direction (coefficient is positive, 0.78 , and significant at the 5% level), however, as mentioned above, this sector represents a rather small share of the working population.

Although the literature at the end of the last century (e.g., Schmidt 1997) highlighted minor dissimilarities within educational levels and employing sectors between post-war immigrants and native workers in Germany, data suggests that these trends seem to have been reversed.

FIGURE 2.11 here

Migrants' Income

The final point of negative narratives regarding migrants pertains to their low incomes. Since the guest worker program began, a low-paid workforce was recruited to cover the growing labor demand in flourishing post-war Germany, many cohorts have joined the labor market in Germany. To better understand where migrants are allocated in the income distribution relative to the native population over time, we estimate the wage dispersion distinguishing between the three sub-groups.

Figure 2.12 shows the development of the earnings (before tax gross monthly labor income deflated by the consumer price index) between the sub-groups classifying incomes across wage brackets. We can see that the foreign-born population and those having a migration background are similarly distributed across wage brackets compared to the group of natives. Overall, the second generation of migrants tends to earn slightly more than foreign-born citizens which can be attributed to better educational opportunities, access to the German educational system, and fewer discriminatory barriers as the acceptance of migrants and their descendants might have improved over time, language proficiency and a better cultural understanding which collectively result in improved labor market integration (Heath et al. 2008, Kogan 2006). Except for the period following 2010 when Germany witnessed a rapid rise in the number of migrants, we do not observe substantial differences in the allocation across the income dispersion of the respective groups.

FIGURE 2.12 here

Considering the share of migrants along income deciles reveals similar tendencies. Figure 2.12 further suggests that over the past 30 years, there has been an overall upward trend towards the upper-income brackets over time. Since 2000, all three sub-groups have experienced a gradual increase in incomes. Even though since the early 2000s those with a migration background have moved considerably towards higher income brackets, the distribution of incomes among the respective groups remains virtually the same over time. This stability can be explained by educational expansion and skill upgrading (e.g., Reimer and Pollak 2010, Kalter and Granato 2002, Spitz-Oener 2006). Additionally, based on individual labor income data, Figure 2.12 illustrates the emergence of a middle class. As a result of economic globalization and the shift from the primary towards the secondary economic sector since the middle of the 1980s, an increasing number of occupations required a qualified and trained workforce which, on the one hand, led to the growth of the upper-middle class and on the other hand, to a reduction of low-income earners and shrinking lower middle class. The emergence of the middle class is not decisive as such but rather reflects an even distribution of incomes by demographic characteristics. Since 2005, the share of natives and second-generation migrants allocated along the bottom of the distribution is decreasing, while increasingly more foreign-born individuals are distributed within the lower-income bracket.

Figure 2.13 illustrates the percentage of the foreign-born across the upper and lower deciles of the income distribution over the last thirty years. We note that although Germany experienced two major immigration waves in 1990 and 2015, the number of foreign-born represented within the deciles does not considerably vary over time, and remains stable. Immigrants in Germany are equally represented across all deciles of the income distribution. Attitudes towards migrants remain unchanged, however, the data does not confirm the negative notion of migrants solely being found in low-wage occupations. Instead, discrepancies between the respective groups diminish and incomes tend to converge over time.

FIGURE 2.13 here

The bottom of the income distribution has seen a rapid rise in the number of immigrants since 2014, which can be explained by the high influx of migrants allocated to low-wage occupations due to a lack of German language proficiency. At the same time, in 2011 Germany was one of the last among the EU-15 countries to open its labor markets to citizens and to grant freedom of movement to workers from eight Eastern European countries that had initially joined the union in 2004. The free movement legislation permits EU citizens to access labor markets across all EU countries, including workers from Estonia, Latvia, Lithuania, Poland, Slovakia, Slovenia, the Czech Republic, and Hungary. In 2014 and 2015 the legislation was extended to

individuals from Bulgaria, Romania, and Croatia. Ever since Germany witnessed a sharp increase in immigration from Eastern Europe. It is worth noting that in 2015 the majority of migrants allocated at the top 10 percent of the income distribution immigrated from Eastern Europe, as illustrated in the Appendix A (Figure 5.1) more than 10 percent were originally from Romania, followed by Poland, Italy, and Russia.

Spatial Dimension

Turning to the regional component of the evolution, the share of the foreign-born population varies greatly across German federal states. Wide-ranging evidence documents the determinants and significance of immigrants' location choices (Rodríguez-Pose and Ketterer 2012, Scott et al. 2005) to explain regional distribution and spatial assimilation. For Germany, ethnic concentration (Tanis 2018) and existing regional ethnic networks (Heider et al. 2020) strongly determine immigrants' location choices, as opposed to merely being drawn to agglomeration.

In order to assess how the proportion of the foreign-born population infers inequality metrics, we analyze and include the proportion of the foreign-born population within each federal state in our empirical model. To gather information about the development of the immigrant population across time and space, as illustrated in Figure 2.14, individual-level panel data has been recompiled on a federal-state level. Firstly, Figure 2.14 implies that the share of the foreign-born population in Germany has changed over time. Secondly, it reveals substantial variations across federal states. The median highlighted in black, demonstrates some of the country's historical milestones. During the 1990s, Germany experienced a significant rise in its foreign-born population by an influx of migrants from Eastern Europe, the Balkans, and the Middle East. After Germany authorized free movement for workers from eight Eastern European countries that had joined the union in 2004, another sharp rise in immigrants was observed in the years following 2010. Overall, the data indicates that the new federal states (Eastern Germany: Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt, and Thuringia) exhibit comparably lower rates of immigrants. According to the data (as shown in Appendix A: Table 5.1), however the share of highly educated migrants holding tertiary education among those few migrants in Eastern Germany is considerably higher.⁷

⁷ The table illustrates the federal state-level data in the year 2000, which was a time when several immigration waves settled. It presents a snapshot of the data we utilize in our empirical model. Note that data is recompiled on the federal-state level from individual-level panel data, leading to one observation per year and state. The data provide insights into the share of the foreign-born population, income inequality Gini coefficients along with the proportions of high-skilled and low-skilled migrants.

FIGURE 2.14 here

In 2000, 10 years after the reunification the share of foreign-born in all 5 new states lies between 1 and 3% while Baden-Württemberg witnessed the highest share of immigrants with 27% of the entire population. Although Baden-Württemberg exhibited a higher share of migrants, the share of highly educated foreign-born individuals in the new states (e.g., Mecklenburg-Western Pomerania with 28%) is substantially higher than in the former (Baden-Württemberg, 4%). It is noteworthy that this trend persists over time. In 2015 the share of the foreign-born in the new states remains low (2-7%), in Hamburg, Nordrhein Westfalia, Hessen, Berlin, and Bavaria the share goes up to slightly more than 30%. While in Saxony 27% of the foreign-born are highly educated (degree educated) only 7% (Bremen) and 10% (Schleswig-Holstein) prove the same. A considerable convergence of educational attainments among the highly educated native and foreign-born population was found in 2015, as outlined in Table 2.1. In the past, the Rhine-Ruhr region formed Germany's economic hub, thus accommodating and attracting numerous guest workers. However, today the region remains an appealing location for immigrants due to established ethnic networks, despite its economic deterioration and worsening labor market conditions, compared to other regions (Glitz 2014). According to Lehmann and Nagl (2019), the economic structure of a region, the presence of immigrant networks, coupled with demographic factors, such as age and gender, are the most salient determinants driving spatial patterns of foreign employment in Germany. Consequently, regions with a greater proportion of service sector jobs and a lower share in manufacturing, a large foreign-born population, and a multicultural young population generally have higher levels of foreign employment.

2.4.4 Migration and income inequality

Having demonstrated a convergence of migrants' educational and occupational accomplishments towards those of natives, we investigate the link between immigration and its relevance to rising economic inequality in Germany. We estimate the following equation,

$$y_{it} = \rho y_{i,t-1} + x'_{it}\beta + \alpha_i + \gamma t + \delta t^2 + \varepsilon_{it} \quad (2.1)$$

where y_{it} is the inequality measure in federal state i in period t , x_{it} is the vector of explanatory variables, α_i is the state effect, t is time trend, and t^2 is the squared trend to account for nonlinear development over time. Our main variable of interest is the 'Proportion of the foreign-born population', that is, we would like to investigate if a larger proportion of migrants is associated with an increase in inequality. However,

since the period under investigation is very long, we introduce the interaction between the time trend and the variable ‘Proportion of the foreign-born population’ to see if the sought effect is constant over time.

The lagged dependent variable is included in Equation (2.1) to track potential persistency in inequality. The arguments in support of and against including lagged dependent variables are discussed in Keele and Kelly (2006). The parameters in Equation (2.1) can be estimated using different estimators such as for example panel fixed-effects (FE) estimator. Nickell (1981) shows the FE estimator will not consistently estimate ρ when there are no exogenous regressors and that the inconsistency is approximately equal to $-(1 + \rho)/(T - 1)$, where T is the time dimension. To remedy this issue, other estimators are the GMM based on the methods suggested and popularized by Arellano and Bond (1991) and later Blundell and Bond (1998). We still choose to use the FE estimator for two reasons. The first reason is more technical and concerns the length of the data. In our case, $T = 30$, and thus the bias for ρ is not going to be considerable and there is no impact on the coefficients of the exogenous regressors if other assumptions hold. The second reason is more conceptual. The GMM estimators are designed for situations where the panel has a small fixed T and a large N . For example, Arellano and Bond (1991) showcased their method using panel data for a sample of 140 U.K. companies observed over 5 years, Banks et al. (1997) performed analysis on 4785 observations. Small N can be a reason for IV proliferation, loss of degrees of freedom, and the cluster-robust standard errors and the Arellano–Bond autocorrelation test being unreliable (Roodman 2009). In our case, T is 30, where Judson and Owen (1999), who study the finite sample properties of both estimators, advocate using the LSDV estimator for an unbalanced long panel, which is exactly our case. Additionally, borrowing from the strategy adopted by the Arellano and Bond estimators, we address potential continuing endogeneity by instrumenting the lagged dependent variable with lags of the lagged dependent variable. More specifically, we use second-order lag (the lag of the dependent variable) as an instrument. The regression results of the latter estimator appear under the label ‘IV’.

Baseline Analysis

Table 2.2 presents the estimation results of the empirical model. The unit of observation is a federal state. Considering that the Gini coefficient is less sensitive to changes at the tails of the income distribution the robustness of the findings is assessed by running the same regression model with the Palma ratio (changes at the top 10 percent relative to 40 percent allocated at the bottom of the income dispersion) as the dependent variable. The results of the regression in the second and third columns

are for the Gini index and in the fourth and fifth columns for the Palma index.

We first consider the Gini index results. The results of the Cragg-Donald Wald test in IV regressions indicate the presence of a strong instrument. The first-stage regression of lagged Gini reveals a coefficient of 0.47 with a t-statistic of 8.90, which signifies a strong association (the first-stage regression results are available upon request). The Underidentification test is satisfied, as evidenced by the Anderson LM statistic equal to 66.44 yielding a p-value < 0.0001 . Additionally, the Weak identification test, as indicated by the Cragg-Donald Wald F statistic, yields a value of 79.15, whereas the Stock-Yogo weak ID test critical value for 10% maximal IV size is only 16.38. All of these results suggest the presence of an appropriate instrument. Furthermore, the Hausman test indicates that both IV and Fixed Effects results can be relied upon, primarily due to the extensive time dimension of the panel data (1985-2015).

To address the potential endogeneity of the rest of the regressors in our analysis, we performed separate regression analyses where we instrumented each independent variable of interest, such as *migrants' income share bottom 10%* and *migrants' income share top 10%* by its lagged value.⁸ In these auxiliary regressions, we performed the Davidson-MacKinnon test of exogeneity. In the case of the *migrants' income share bottom 10%* regressor, the p-value of the test is equal to 0.9336, indicating that there is no evidence of endogeneity for this variable. Similarly, for the *migrants' income share top 10%* regressor, the p-value of is equal to 0.3396; for the *proportion of highly skilled* regressor, the p-value is equal to 0.2564, and in the case of the *proportion of low skilled* regressor, the p-value is equal to 0.0856. We therefore do not find evidence of endogeneity for our regressors and proceed using these regressors as they are.

TABLE 2.2 here

The share of the foreign-born population does not have a substantial impact on the level of income inequality in either IV or FE regression. The finding remains robust to the choice of inequality measure: the Gini or the Palma index. The result provides evidence that the proportion of migrants is not linked to rising inequality. The same holds for the number of low and highly-skilled migrants, estimates in all regression models imply statistical insignificance in the proportion of low and highly-educated migrants. With regards to the percentage of income that is allocated to migrants within the top 10 and bottom 10 of the income distribution, we do not find a significant long-term effect driving income inequality. The interaction between the time trend and the proportion of foreign-born is statistically insignificant, however, this coefficient by itself is not informative. It is valuable to track the marginal effect of the foreign-born variable on inequality over time. Figure 2.15 shows how the

⁸ We thank the anonymous reviewer for this insight.

predicted inequality parameter changes with the variation of the variable *percentage of foreign-born population* while keeping all other variables constant along with the 95% confidence intervals. The two upper panels (a) and (b) show the marginal effects for the Gini and Palma indices in Table 2.2.

FIGURE 2.15 here

The confidence intervals in both panels (a) and (b) are rather wide. In panel (a), the marginal effect appears to be only slightly significant beginning from around 1998. This suggests that, despite the rising proportion of migrants, there may even be a slight decrease in inequality. However, the combination of panels (a) and (b) does not offer conclusive evidence that the increasing rates of immigration are definitively linked to a rise in inequality.

Extended Analysis

The presented regression analysis examined migration-related characteristics on inequality measures. However, to better understand how the public migration-related sentiment affects economic inequality measures, we conduct an extended analysis combining migration-related variables used in (2.1) with the sentiment data obtained from Twitter. Because these data are available from 2007, the analysis is performed for the period 2007-2015, which reduces our original sample almost by two-thirds. Additionally, we control for the state-level *unemployment rate*, which has been available only for this period. Due to the above restrictions, the panel size is $\sum_i T_i = 144$. The results of this extended analysis shown in Table 2.3, confirm the findings of the initial regression. Additionally, it shows that immigration narrative sentiments play a negligible role in determining levels of economic inequality in Germany. The panel (c) in Figure 2.15 shows that the effect is statistically zero and is not changing over time.

TABLE 2.3 here

2.5 Discussion

We show that fears about immigration and inequality are not based on empirical evidence. Our findings imply that the growing trend of inequality as illustrated by the increasing Gini coefficient in Figure 2.4 and Figure 2.5 above is not attributed to migration-related patterns in Germany. Arguably, the rise of the Gini index in Germany may well be ascribed to a broad array of global challenges, namely, the growing polarization of incomes, residential segregation, technological advances or

increases in international trade (Weil 2012), institutional change (Antonczyk et al. 2018, Roser and Crespo Cuaresma 2016) and specifically the growth in top incomes as outlined in Piketty (2005) and Piketty and Saez (2003) among others. The rationale behind the rise in Gini in Germany calls for further systematic research which is beyond the scope of our study.

The numerous fallacies or mistaken beliefs spread in society are analyzed here and not substantiated by empirical evidence.

A society's historical memory serves as a powerful cultural marker that shapes attitudes toward migrants. Long-standing narratives, rooted in historical memory, can significantly impact how individuals perceive newcomers. These narratives can foster bigotry, biases, or fears that have been passed down through generations, resulting in a constancy of attitudes toward migrants. We anticipate that the regional science audience will see an increased awareness of Pierre Bourdieu's scientific contribution.

Abramitzky and Boustan (2022) use textual analysis to demonstrate that attitudes toward immigration are more positive than at any time in US history - but increasingly polarized. The evidence that they provide goes against the notion of immigrant families and their children being trapped in a perpetual lower social class.

Our findings show that the foreign-born population is neither overwhelmingly represented in low-wage occupations nor lags behind the native population in terms of educational attainment. Overall, the results suggest that immigration-relevant characteristics do not exhibit a sizeable effect on federal-state-level income inequality which shapes aggregate income inequality. Hence, the salient finding of the study is that a combination of immigration-related and immigration-educational dynamics does not increase income inequality. Further, the convergence of educational and occupational achievements among natives and the foreign-born suggests that neither group can be solely held responsible for rising economic inequality.

2.6 Conclusion

This paper studies the evolution of educational, occupational, and income patterns of migrants in Germany from 1985 to 2015. The German context is particularly noteworthy for various reasons. On the one hand, the country and economy heavily depend on immigrants, a fact acknowledged by politicians across different levels. On the other hand, migrants are often subjected to unfair treatment within society, with perceptions that individuals of migrant backgrounds often have lower educational attainment, are relegated to low-skilled jobs, receive lower wages, or rely heavily on social welfare programs. This negative treatment of migrants fosters unfavorable sentiments towards them within society and contributes to the perception that migration

exacerbates inequality.

By utilizing data from SOEP as well as from Twitter (now X platform), we analyze tendencies in inequality and migration. While the findings may not permit a causal interpretation, they do provide valuable insights. Firstly, we demonstrate that migrants are catching up to their native counterparts in terms of education, occupations, and income. Secondly, we find no evidence to suggest that the proportion of immigrants is associated with an increase in economic inequality. On the contrary, the larger proportion of migrants has even reduced income inequality from around 2000. Finally, negative public sentiments towards immigrants are not linked to the rise in regional inequality.

The results suggest important implications. It is known that narratives can shape policies (Shiller 2017). Consequently, it is crucial to encourage discourse in society regarding immigration and inequality that is founded on empirical evidence. This study disproves certain misconceptions about the role and impact of immigrants in the German economy and society, which may facilitate constructive dialogue that promotes fairness and prevents the erosion of social cohesion.

Tables and Figures

Negative



Positive

Figure 2.1: Polarity of most frequent words

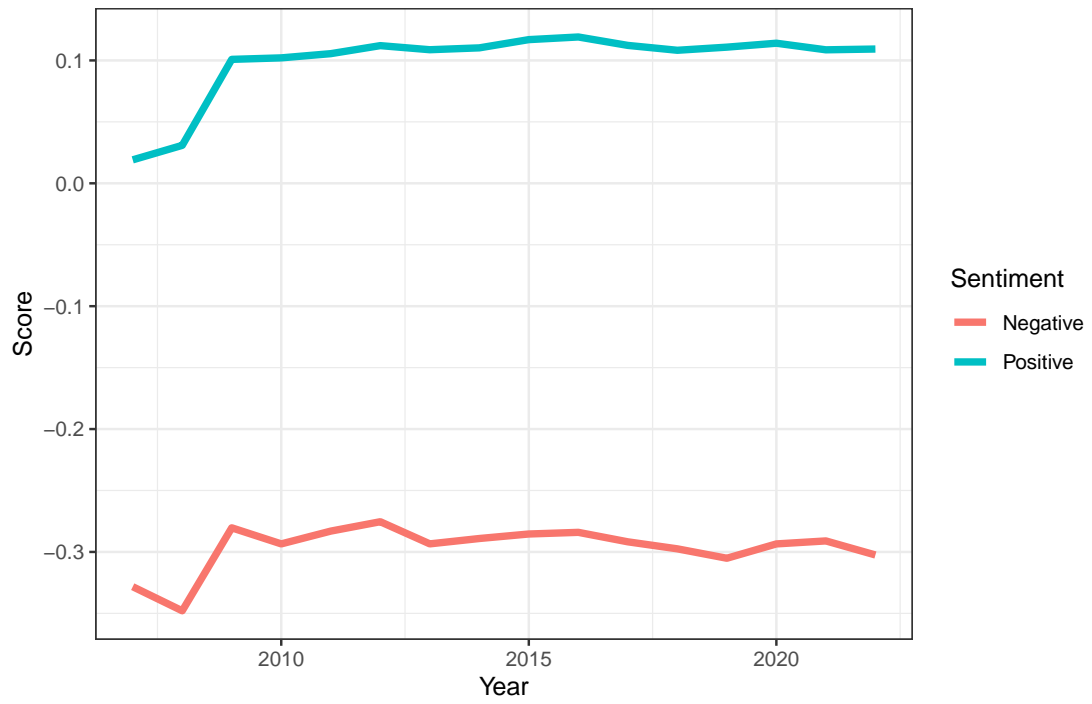


Figure 2.2: Sentiment Median

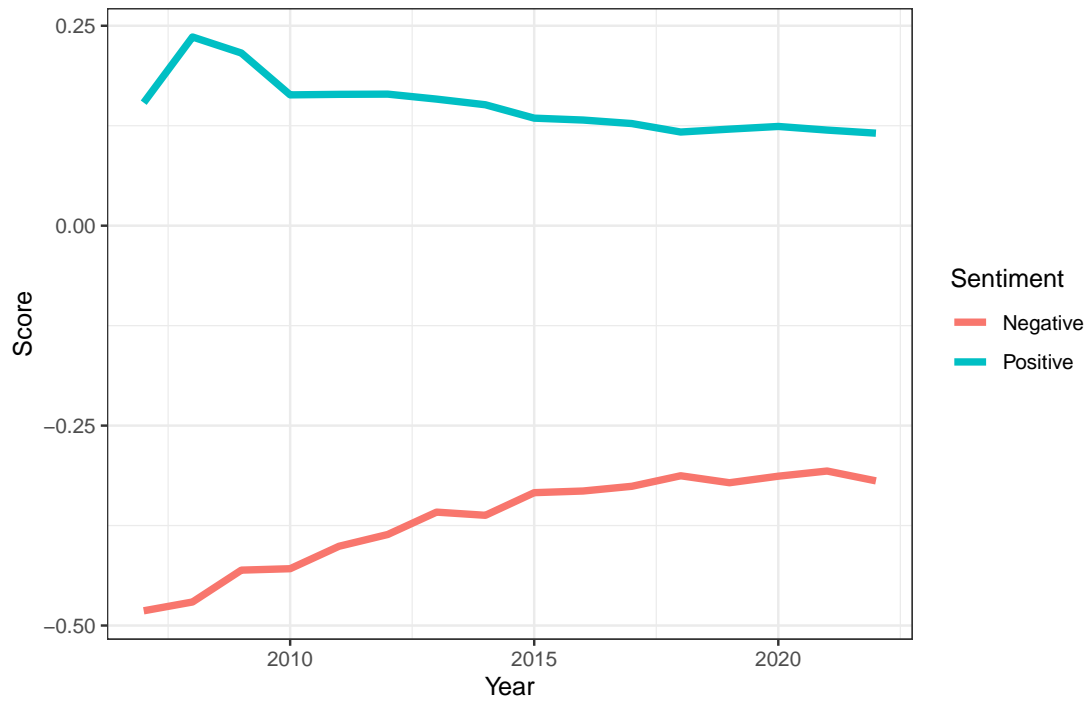


Figure 2.3: Sentiment N10th P90th

Notes: This graph illustrates the most negative (10th percentile of negative sentiments) and the most positive (90th percentile of positive sentiments). sentiments.

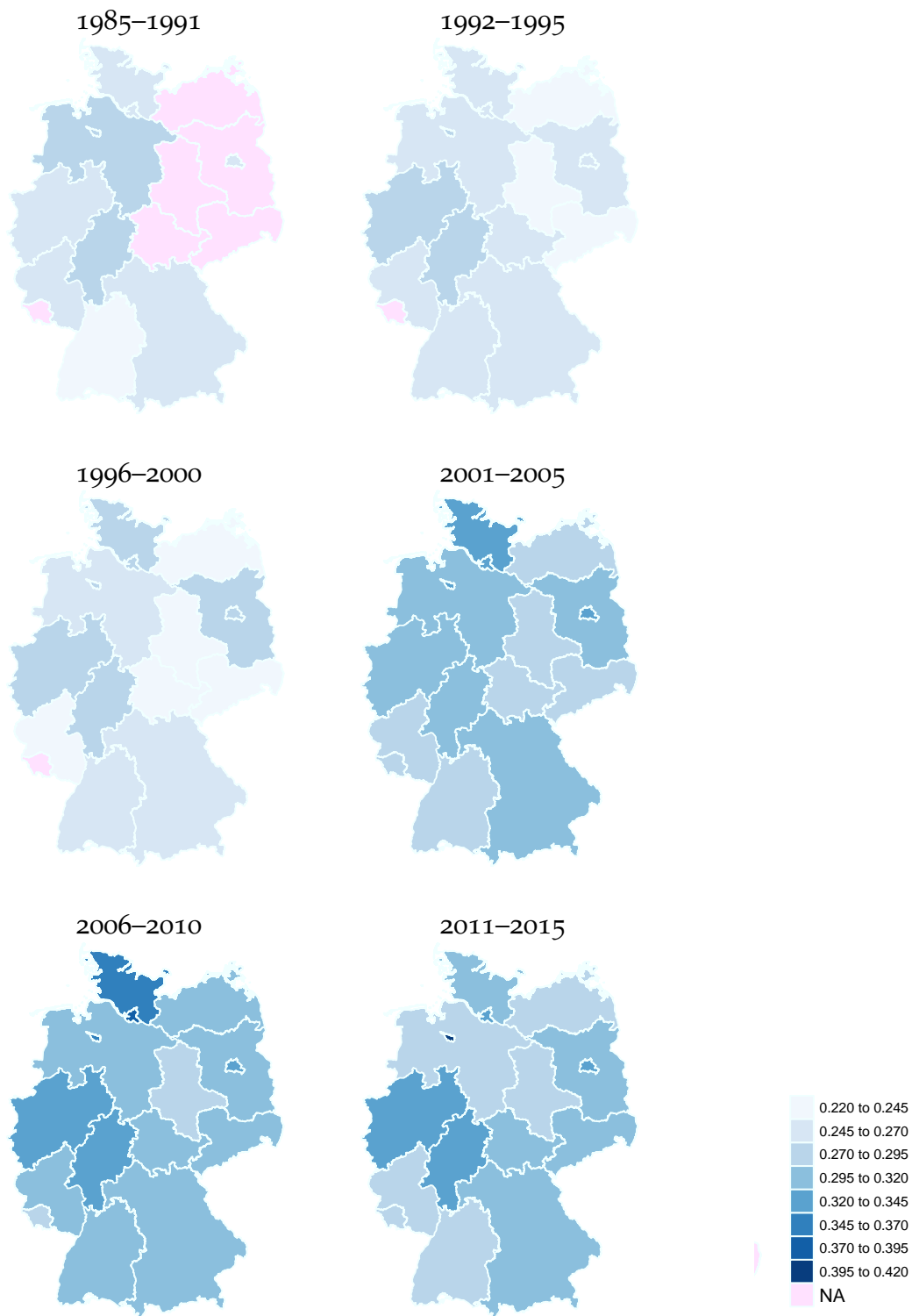


Figure 2.4: Gini, average over sub periods

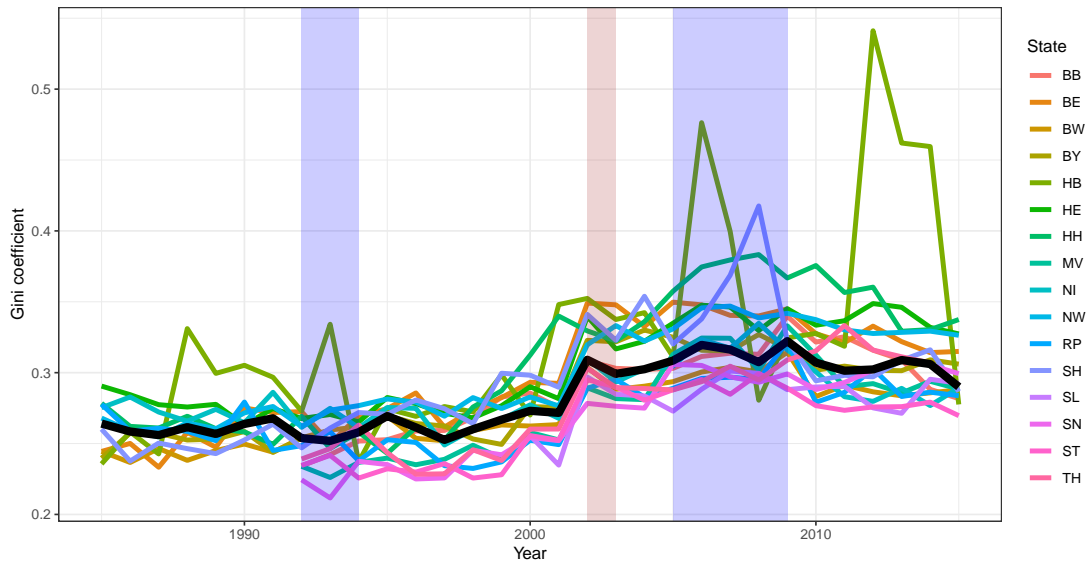


Figure 2.5: Federal State Gini inequality

Notes: Note, data for East German states available after reunification, from 1992 onward.

BW Baden-Württemberg, BY Bavaria (Free State), BE Berlin, BB Brandenburg, HB Bremen (Hanseatic City), HH Hamburg (Hanseatic City), HE Hesse, MV Mecklenburg-Western Pomerania, NI Lower Saxony, NW North Rhine-Westphalia, RP Rhineland-Palatinate, SL Saarland, SN Saxony (Free State), ST Saxony-Anhalt, SH Schleswig-Holstein, TH Thuringia (Free State)

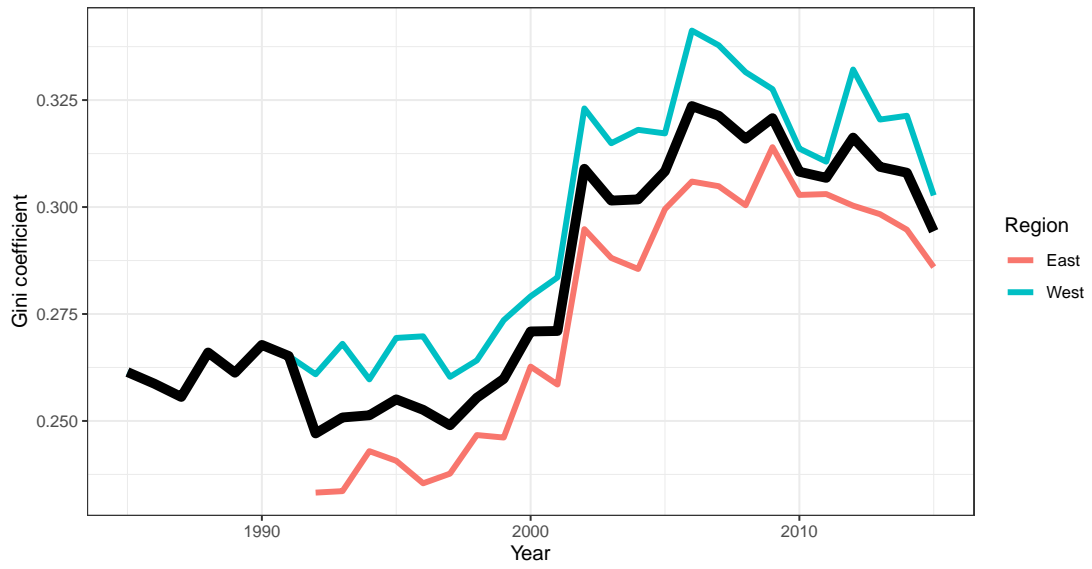


Figure 2.6: Regional Gini inequality Germany

Notes: Note, data for East German states available after reunification, from 1992 onward.

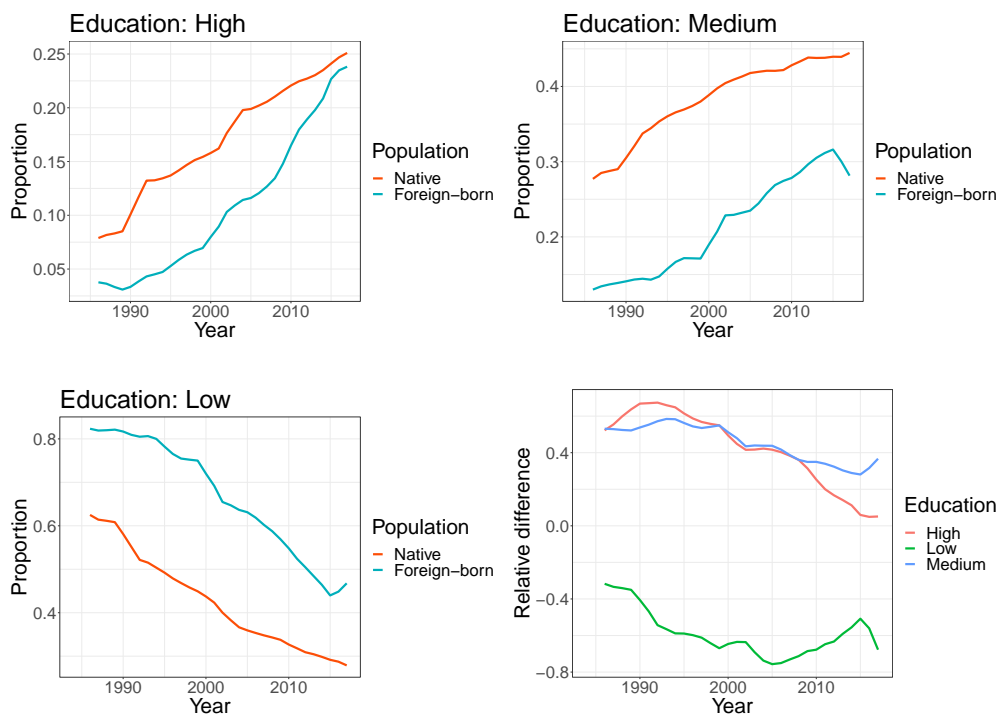


Figure 2.7: Differences in educational attainments against proportion within population

Notes: The figures show the 3-year moving average to avoid short-term fluctuations.

Source: SOEP, v.35; own calculations.

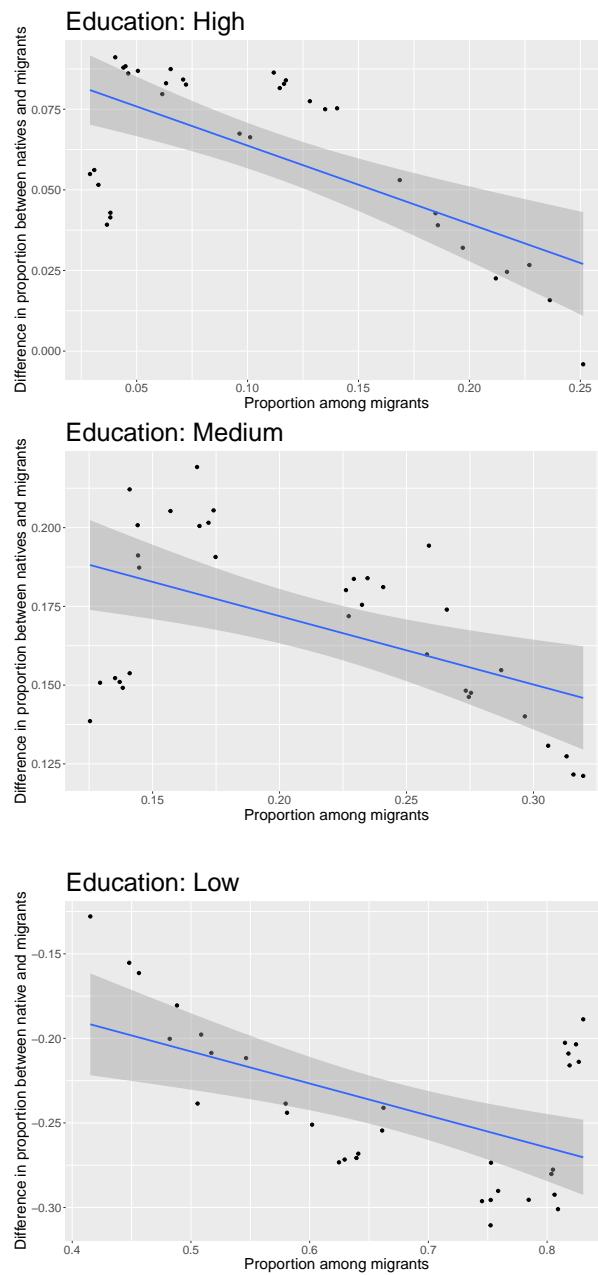


Figure 2.8: Educational convergence

Notes: The above figures show the convergence regression. The negative slope implies a convergence of educational attainment between natives and migrants.

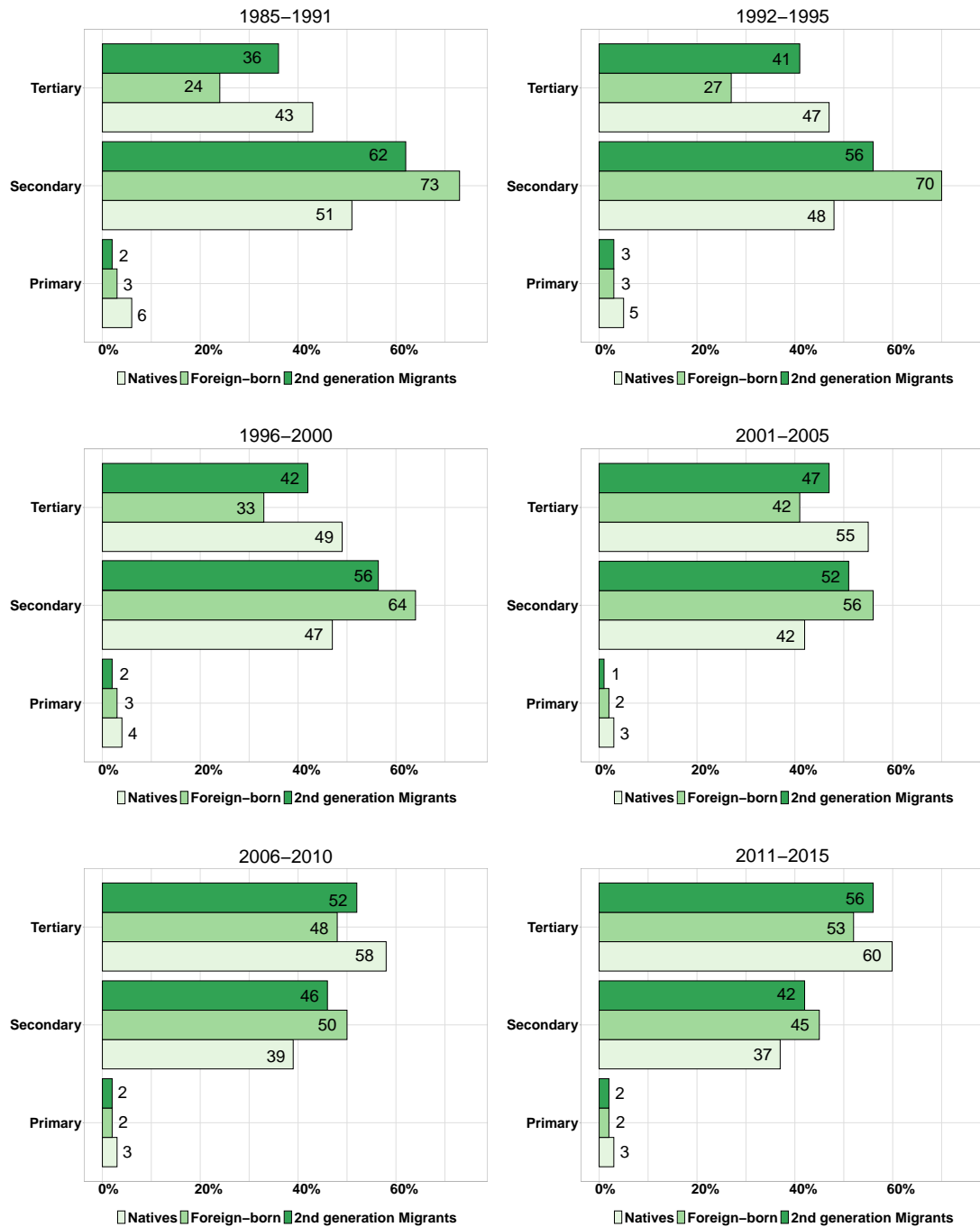


Figure 2.9: Natives and Migrants across sectors

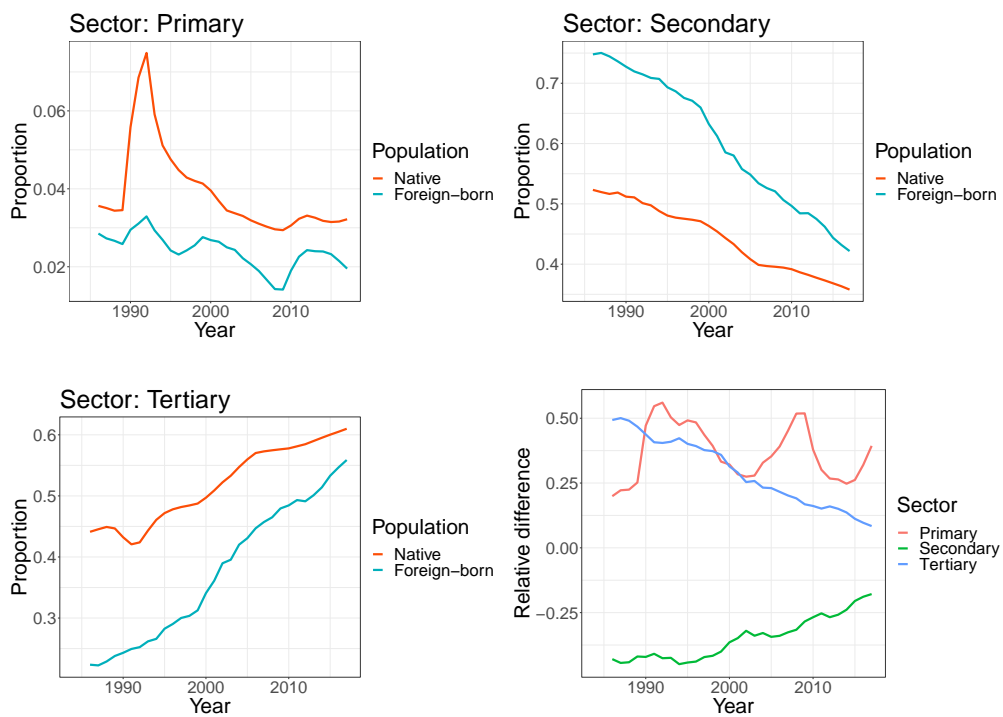


Figure 2.10: Differences in occupational attainments against proportion within population

Notes: The figures show the 3-year moving average to avoid short-term fluctuations.

Source: SOEP, v.35; own calculations.

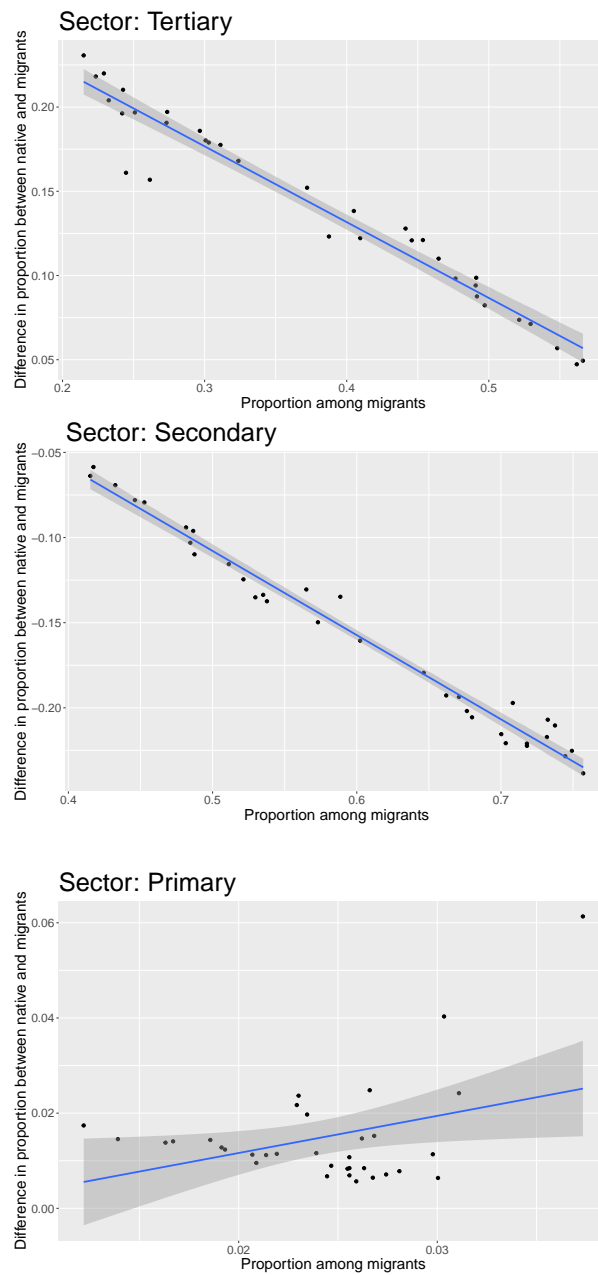


Figure 2.11: Occupational convergence

Notes: The above figures show the convergence regression. The negative slope implies a convergence of occupational allocation between natives and migrants.

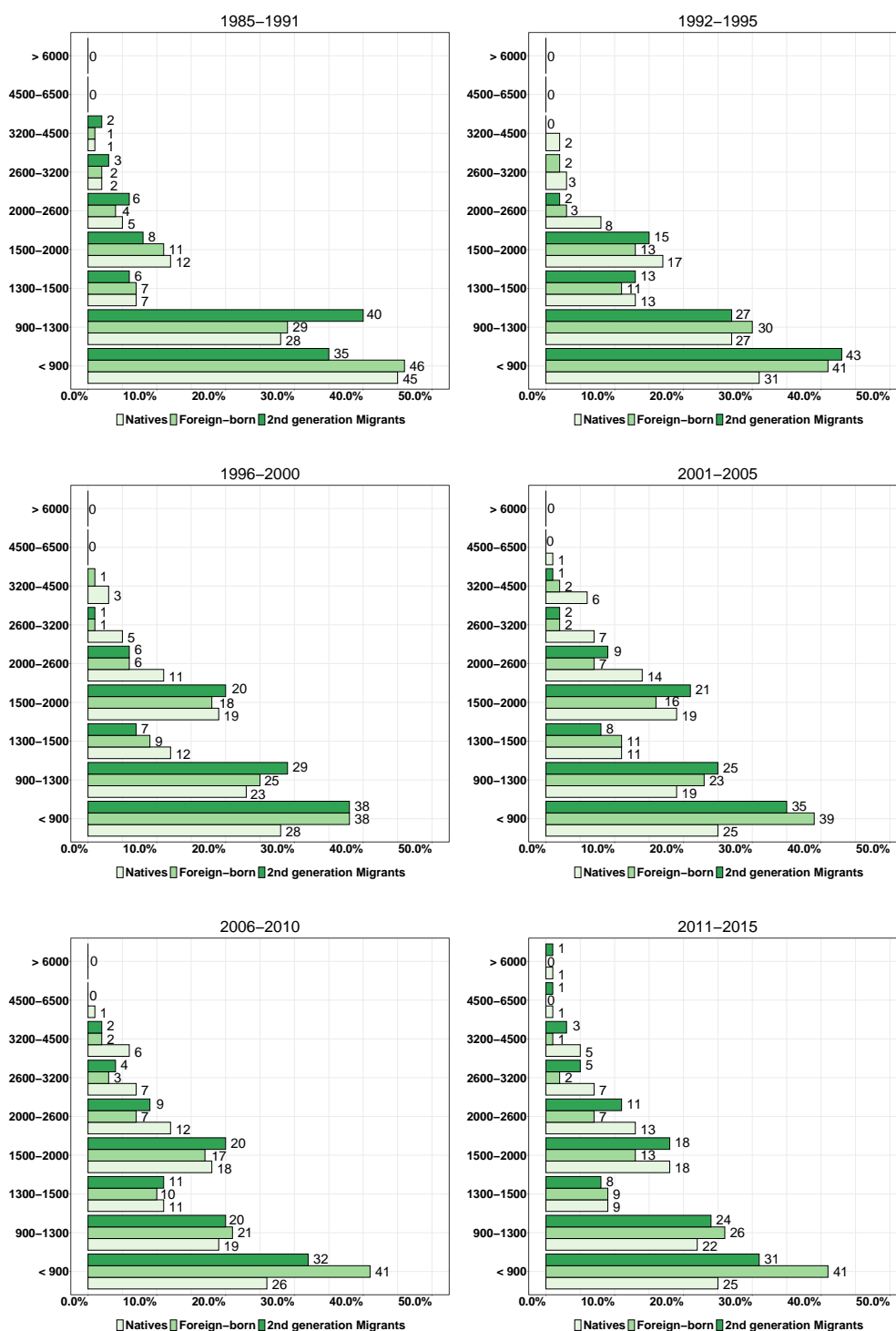


Figure 2.12: Natives and Migrants across the wage distribution

Notes: The numbers at bars show rounded percentage in each of three groups. They do not add to exactly 100 due to rounding. Zeros are actually percentages that are lower than 0.5; there is not a single category where the percent is 0.

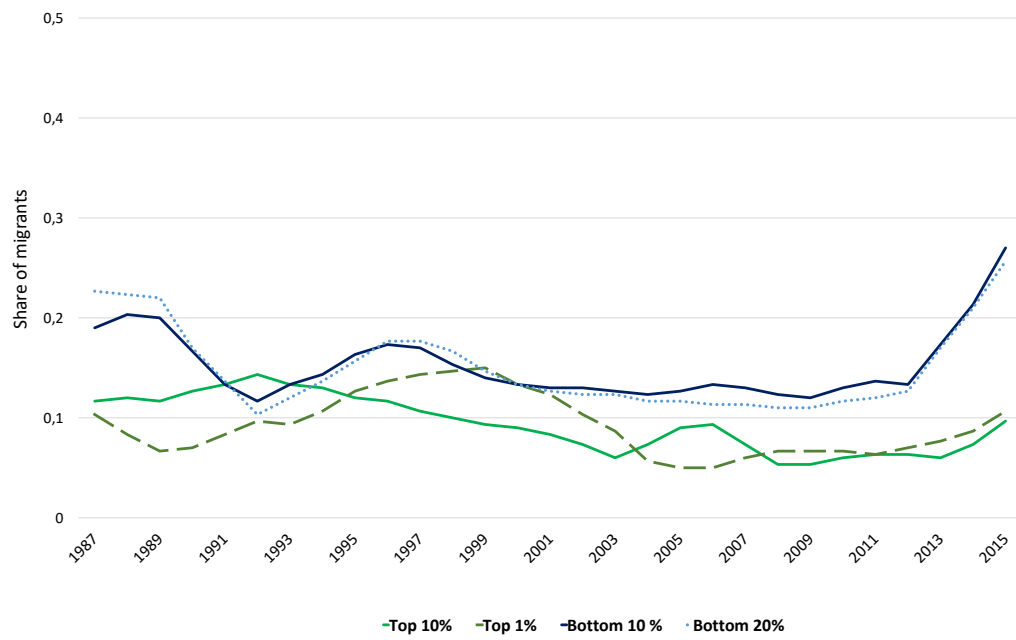


Figure 2.13: Share of migrants across income deciles

Notes: To avoid short-term fluctuations and make the lines smoother, the figure shows the 3-year moving averages.

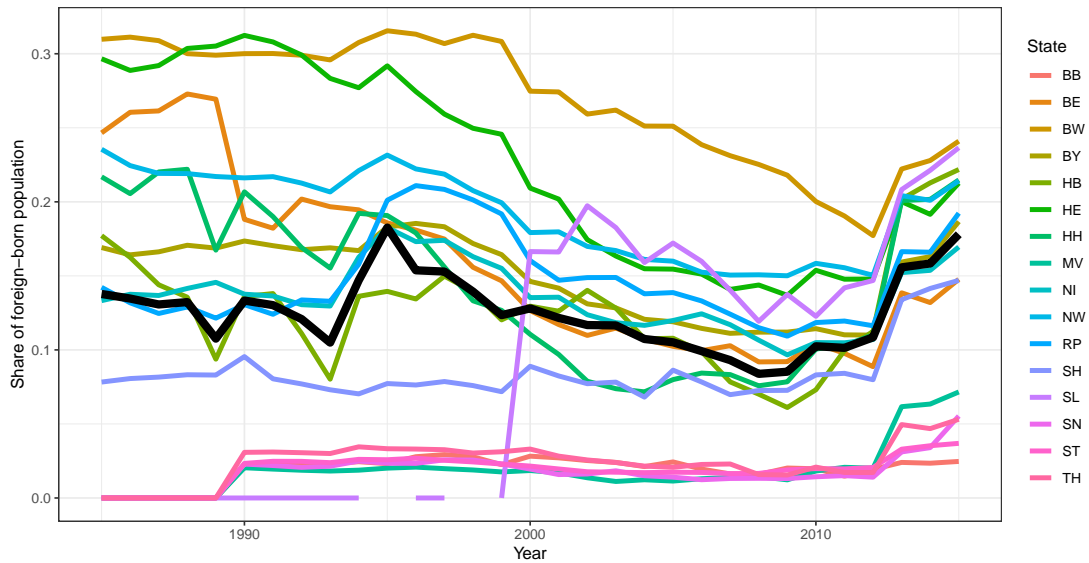


Figure 2.14: Proportion of immigrants by Federal State

Notes: Note, data for East German states available after reunification, from 1992 onward.

BW Baden-Württemberg, BY Bavaria (Free State), BE Berlin, BB Brandenburg, HB Bremen (Hanseatic City), HH Hamburg (Hanseatic City), HE Hesse, MV Mecklenburg-Western Pomerania, NI Lower Saxony, NW North Rhine-Westphalia, RP Rhineland-Palatinate, SL Saarland, SN Saxony (Free State), ST Saxony-Anhalt, SH Schleswig-Holstein, TH Thuringia (Free State)

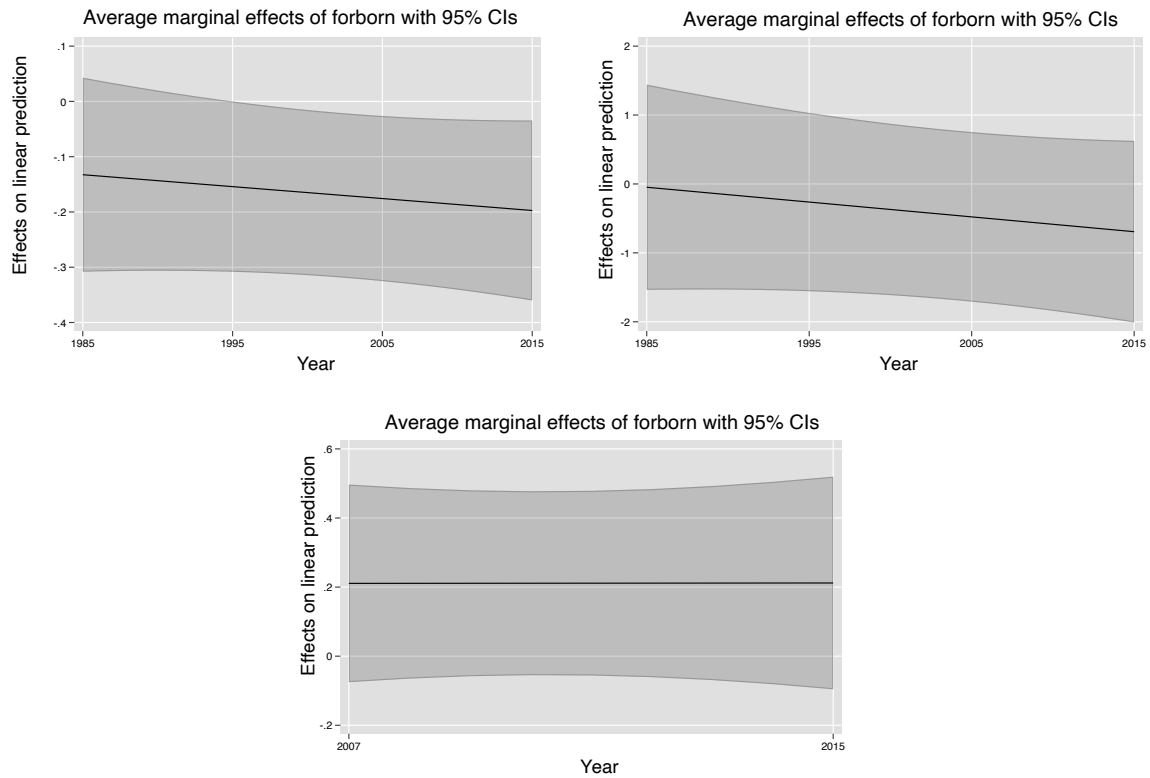


Figure 2.15: Marginsplots

Notes: These marginsplots visualise the marginal effect of the foreign-born population (%) while holding the other variables constant, on the predicted outcomes as shown in: a) Gini; b) Palma; c) Gini, year > 2007.

The black line shows the estimated marginal effect of the foreign-born population on the inequality estimate and the uncertainty in the prediction/confidence interval is depicted in shaded colouring. A statistically significant effect is found, in case that the confidence interval does not overlap with zero.

Table 2.1: Educational attainment over time.

Educational level	Native population				Foreign-born			
	1985	1995	2005	2015	1985	1995	2005	2015
High	7.96	14.13	20.12	24.72	3.82	6.16	11.73	25.13
Medium	28.01	36.55	42.19	44.08	12.93	17.48	24.08	31.96
Low	62.09	47.92	35.14	28.74	82.44	75.28	62.47	41.52
In school	1.94	1.4	2.55	2.47	0.81	1.08	1.72	1.39
N	14319	25681	42662	45485	4627	6608	6867	10704

Notes: data in %; classification based on CASMIN (0= in school; 1-3= low; 4-7= medium; 8-9= high)

Source: SOEP, v.35; own calculations.

Table 2.2: Dependent variables are Gini index and Palma ratio

	Gini index		Palma ratio	
	FE	IV	FE	IV
Gini index (-1)	0.388*** (7.76)	0.400*** (3.46)		
Palma ratio (-1)			0.378*** (7.31)	0.454*** (3.29)
Proportion of the foreign-born population	-0.130 (-1.44)	-0.129 (-1.42)	-0.114 (-0.15)	-0.021 (-0.03)
Proportion of the foreign-born population × Trend	-0.002 (-0.82)	-0.002 (-0.79)	-0.021 (-0.92)	-0.021 (-0.96)
Low skilled migrants	-0.019 (-0.99)	-0.019 (-0.97)	-0.013 (-0.08)	-0.013 (-0.08)
Highly skilled migrants	-0.047 (-1.38)	-0.046 (-1.3)	-0.194 (-0.68)	-0.135 (-0.45)
Migrant income share bottom 10	-0.129 (-0.11)	-0.183 (-0.14)	-6.803 (-0.66)	-10.239 (-0.87)
Migrant income share top 10	0.052 (1.00)	0.053 (1.01)	-0.158 (-0.36)	-0.143 (-0.33)
Percent of GDP by Federal state	1.046** (2.09)	1.028** (1.96)	10.158** (2.44)	9.244** (2.08)
Trend	0.007*** (4.75)	0.006*** (4.23)	0.040*** (3.53)	0.037*** (2.93)
Trend Squared	-1e-4*** (-3.69)	-1e-4*** (-3.58)	-1e-3** (-2.58)	-1e-3** (-2.34)
Intercept	0.067* (1.95)	0.065* (1.75)	-0.334 (-1.19)	-0.323 (-1.15)
R^2	0.6249	0.6248	0.4837	0.481
Cragg-Donald Wald test		79.50***		56.99***
Overall p-value	(< 0.001)	(< 0.001)	(< 0.001)	(< 0.001)
N (number of federal states)			16	
T (number of years)			14–25	
$\sum_i T_i$ (total number of observations)			372	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. z-statistics are reported in parentheses. Unit of observation is a federal state. IV stands for the instrumental variables and FE stands for the Fixed Effects estimation. “Foreign-born population”, “Low skilled migrants”, “Highly skilled migrants”, “Migrant income share bottom 10”, and “Migrant income share top 10” are measured as proportions.

Table 2.3: Dependent variable Gini index

Variable	M5	M6	M7	M8
Gini index (-1)	0.637*** (4.16)	0.637*** (4.15)	0.635*** (4.16)	0.639*** (4.22)
Proportion of the foreign-born population	0.208 (0.46)	0.208 (0.46)	0.210 (0.46)	0.206 (0.45)
Proportion of the foreign-born population \times Trend	1e-3 (0.01)	1e-3 (0.01)	1e-3 (0.01)	1e-3 (0.01)
Low skilled migrants	-0.036 (-0.84)	-0.035 (-0.83)	-0.035 (-0.82)	-0.036 (-0.83)
Highly skilled migrants	-0.010 (-0.17)	-0.011 (-0.17)	-0.010 (-0.17)	-0.010 (-0.17)
Migrant income share bottom 10	-3.373 (-0.98)	-3.347 (-0.96)	-3.330 (-0.97)	-3.407 (-1.00)
Migrant income share top 10	-0.171 (-0.81)	-0.175 (-0.81)	-0.173 (-0.82)	-0.168 (-0.80)
Percent of GDP by Federal state	0.046 (0.99)	0.046 (0.99)	0.046 (0.99)	0.045 (0.98)
Unemployment rate	-0.043 (-0.39)	0.044 (-0.40)	-0.042 (-0.38)	-0.043 (-0.39)
Trend	0.015 (0.67)	0.013 (0.46)	0.015 (0.63)	0.016 (0.66)
Trend Squared	-1e-3 (-0.70)	-1e-3 (-0.59)	-1e-3 (-0.64)	-1e-3 (-0.69)
Negative Sentiment		0.045 (0.13)		
Positive Sentiment			0.010 (0.10)	
Sum of Sentiments				-0.009 (-0.09)
Intercept	-0.074 (-0.24)	-0.016 (-0.03)	-0.068 (-0.21)	-0.089 (-0.25)
R^2	0.4720	0.4721	0.4720	0.4720
Cragg-Donald Wald test	71.72***	72.26***	71.38***	71.95***
Overall p-value	(< 0.001)	(< 0.001)	(< 0.001)	(< 0.001)
N	16	16	16	16
$\sum_{i=1}^N T_i$	144	144	144	144
N (number of federal states)			16	
T (number of years)			9	
$\sum_i T_i$ (total number of observations)			144	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. z-statistics in parentheses. Unit of observation is a federal state.

Chapter 3

Multidimensional Vulnerability of Households: Shortfall in Housing, Employment, Health Attainments in Germany

3.1 Introduction

Well-being, as an aspired aim, lies at the core of overall quality of life - vulnerability in contrast, signifies susceptibility to adverse outcomes. To attain a comprehensive understanding of the vulnerabilities that diminish well-being, it is necessary to extend beyond traditional economic measures, such as income and instead consider multiple dimensions. In this paper, we aim to examine the multidimensional nature of vulnerability faced by households, specifically focusing on housing, health, and employment.

We build upon the established definition of vulnerability found in the existing literature, which defines vulnerability as a state of defencelessness in the face of adverse shocks (e.g., Dutta et al. (2011), Chaudhuri (2003), Ligon and Schechter (2003)). On the empirical side vulnerability has been studied with a significant emphasis placed on vulnerability to financial shocks (consumption vulnerability) (Kocher 1995, Jalan and Ravallion 1999, Pritchett et al. 2000), however this (limited) perspective falls short in capturing the full range of adversities and uncertainties households witness. By employing a multidimensional approach, we propose a method to break down household level vulnerability into multiple dimensions that ultimately enable households to achieve a certain level of well-being.

The public agenda has gradually shifted towards addressing disparities in accessibility, affordability and availability of health services and housing as well as inequal-

ities in employment prospects to comprehend the intricate complexities of vulnerability. Overall, 16 percent of renters had a rent burden of more than 40 percent with 1.5 million households facing a rental burden of more than half of tenants' income¹. While there is an incentive to raise the minimum wage in Germany to adhere to the principle of '*ensuring that full-time workers are not subjected to poverty*', recent data from the Ministry of Labour (Plueck 2023) reveals a concerning trend. Accordingly, the count of individuals engaged in multiple jobs has seen a significant increase of 40 percent in recent years and a majority of these multi-jobbers are skilled workers who have at least completed vocational training. In addition, the European Parliament autumn Euro-barometer² revealed that 42 percent of Europeans select public health as their top priority, followed by 40 percent who place emphasis on addressing poverty and social exclusion.

Despite the consensus that both poverty and vulnerability are multidimensional in nature and numerous efforts have been undertaken to quantify these (Alkire and Foster (2011a), Alkire et al. (2015), Tsui (2002)), there is currently no single comprehensive and robust methodology available to accurately estimate vulnerability across multiple non-pecuniary dimension such as health, housing and employment that accounts for the dimensional interconnections. In theory, multidimensional vulnerability shares some similarities with multidimensional poverty, as both aim to identify individuals experiencing significant deprivations simultaneously, for a comprehensive overview, consider Aaberge and Brandolini (2015) and Alkire et al. (2022). However, multidimensional vulnerability diverges from multidimensional poverty in its broader focus. Unlike the latter, multidimensional vulnerability not only concerns those currently deprived but also places a critical emphasis on individuals who may be exceptionally susceptible to being unequally affected by external shocks or adverse events.

This research contributes to multiple strands of literature. First, it provides a multivariate method to estimate multidimensional household vulnerability focusing on health, employment and housing. We measure the multidimensional vulnerability on the household level relative not to their own potential of well-being, but to the potential that prevails within society. This offers a valid approach to measure vulnerability under specific conditions in a given time frame. Applying Principal Component Analysis (PCA) we estimate three indices (health, housing, employment) and propose a straightforward method of aggregation from the individual to household-level data. This approach accounts for the interdependence among household members.

Through the use of a longitudinal lens, we can not only apprehend the different areas where individuals may face shortcomings beyond financial constraints, but

¹ Destatis (2023)

² <https://europa.eu/eurobarometer/surveys/detail/2932>

also uncover how these vulnerabilities develop and change over time. The proposed method provides a valuable framework for estimating, addressing and resolving major societal challenges.

Second, the empirical application of the proposed method using SOEP³ household data reveals heterogeneity of vulnerability prevalence across German Federal States, no differences between native and mixed household are observed, but significant differences between native and those with all varieties of migration backgrounds⁴ among all household compositions are found. Taking into account various household compositions, resources and the household life-cycle, our findings uncover that single households below the age of 35 exhibit lower household achievement compared to other single households. Single parents and families with multiple children also tend to display lower household achievements, indicating higher exposure to vulnerability on the household level. Policy interventions addressing the unique challenges faced by immigrant households, such as revising standardized administrative procedures/reducing access barriers/bureaucracy to social services may be suggested.

The rest of the paper is organized as follows. Section 3.2 provides a comprehensive review of relevant literature. In Section 3.4 we outline the methodology employed to construct the three vulnerability indices and how these are applied to estimate vulnerability and its determinants. Section 4.5 presents the empirical findings. Section 4.6 discusses the results and potential policy implications. Section 3.7 concludes.

3.2 Literature Review

We will start by conducting an extensive literature review on vulnerability, exploring its distinctions from poverty and examining prevalent methodologies of both concepts. This aims to embed our innovative approach within the pertinent academic discourse. Subsequently, we will expand on the domain of health, housing, and employment disparities.

3.2.1 Theoretical vulnerability approaches

There is an ongoing scholarly debate over the concept and estimation of vulnerabilities in the economic literature. The present work makes a substantial methodological contribution to the quantification of vulnerability and its causes.

This section recapitulates and discusses various vulnerability concepts relevant to

³ The German Socio-Economic Panel (SOEP) is a longitudinal household panel survey.

⁴ This refers to households composed of first and second generation migrants.

the subsequent analysis. As outlined in [Gallardo \(2018\)](#) and [Fujii \(2016\)](#), theoretical vulnerability concepts traditionally fall into one of the following categories: estimation of vulnerability as expected poverty (VEP), vulnerability as risk exposure (VER), low expected utility or utility gap (VEU) and those supported by a mean-deviation approach (for an application, see, e.g. [Chiwaula et al. \(2011\)](#)). VER analyses ex-post to which extent derived welfare diminished due to adverse shocks, for example the inability to smooth consumption (e.g., [Skoufias and Quisumbing \(2005\)](#)), while VEP is concerned with the likelihood of a household to fall below the poverty line at a future point in time (see, e.g., [Pritchett et al. \(2000\)](#), [Chaudhuri et al. \(2002\)](#), [Kamanou and Morduch \(2002\)](#), [Christiaensen and Subbarao \(2005\)](#)). Vulnerability determined as an expected utility gap (VEU), as for instance applied by [Ligon and Schechter \(2003\)](#), [Calvo and Dercon \(2013\)](#) or [Günther and Maier \(2014\)](#), estimates vulnerability as the distance between the obtained household utility at a future state accounting for aggregate and idiosyncratic risk, inherent to uncertainty and the utility a household derives from an optimal consumption level. Perhaps the most serious limitation of this approach is the bias arising from the integration of risk into the utility calculations, which is inherent in the way risk is defined as an integral part of obtained utility in the VEU approach. Accounting for multiple socio-demographic and socio-economic determinants on the household level, we contribute to the literature estimating vulnerability in terms of a utility gap between a household's overall potential as a benchmark and the actual household performance. The subsequent section proceeds to review the pertinent literature on methods that aid in identifying vulnerable or impoverished populations from a multidimensional perspective.

3.2.2 Poverty measures

Vulnerability expands upon poverty estimation through its broader inclusion of multifaceted risks, uncertainties, and determinants that extend beyond mere economic factors, providing a more comprehensive perspective of individuals at risk ([Gallardo 2018](#)). Poverty is a significant concern for both growing and advanced nations, the varying levels of poverty are typically assessed in absolute and relative terms. While absolute measurement sets a fixed threshold for basic necessities⁵, relative measurement compares individuals to the average living standard, reflecting social inequalities. Based on the latter individuals are classified as relatively poor if their weighted household income falls below 60 percent of the median of all equalised incomes in a country ([Atkinson et al. 2002](#)).

Research on poverty, particularly income poverty, has revealed several fundamental findings. One of the critical findings is that poverty is not evenly distributed

⁵ By definition of the Worldbank in 2022, relating to those having less than \$2.15 per person per day.

across populations, with certain groups such as women, children, racial and ethnic minorities, and people with disabilities being more prone to experience poverty than others (e.g., [Buvinić and Gupta \(1997\)](#), [Atkinson et al. \(2002\)](#)). Another substantial argument is that poverty is not a mere earnings deficiency, but rather a multidimensional phenomenon closely linked to inequalities affecting individuals' access to education, healthcare, housing, and other basic needs. It can also impact individuals' social and psychological well-being, leading to social exclusion and or low self-esteem. Existing literature, acknowledges the importance of concise approaches to identify the deprived population for effective policy formulation. The identification of the impoverished population and the estimation of a comprehensive measure have been extensively debated within the scientific community (e.g., [Deaton 2005](#), [Ravallion 1996](#), [Sen 1993](#), [Townsend 1962](#)). A significant methodological challenge in the field revolves around effectively capturing the multidimensionality of these phenomena. This study aims to make a substantial methodological contribution to address this issue. [Nussbaum and Sen's \(1993\)](#) seminal work on quality of life highlights the essential institutional and material prerequisites for individuals to pursue a life that they perceive as meaningful and fulfilling. A major challenge of the approach presents its operationalisation, there is a modest agreement on the dimensions, criteria and weighting. Further, quantifying poverty in terms of opportunities for contentment lacks agreement on the interpretation of a shortfall of such opportunities and the identification of those affected. Adopting a multidimensional perspective on poverty is critical for understanding its complexities, identifying specific vulnerable populations, and developing effective strategies to alleviate it. Comparing four philosophical approaches to Human Development ([Narayan et al. \(2000\)](#), [Cummins \(1996\)](#), [Allardt \(1993\)](#), and [Sen \(1985\)](#)), [Ramos and Silber \(2005\)](#) observes a weak correlation between material well-being, specifically income (adjusted for purchasing power parity) and other dimensions of human development. Employing efficiency analysis, the findings illustrate the necessity of a multidimensional perspective when quantifying poverty, as the overall level of human development is found to be more evenly distributed than its individual components.

The first serious discussions and analyses on how to conceptualise the multidimensional nature of poverty emerged during the 1970s pioneered by Amartya Sen. [Sen \(1976\)](#) introduced two axioms a reasonable poverty measure should satisfy, the *monotonicity* and *transfer* axiom respectively. Firstly, if the income of a by definition, poor individual is reduced, the poverty measure should increase (monotonicity), secondly, a transfer of income from a poor to another individual who is comparably better off, should result in an increase of measured poverty (transfer axiom). In line with the above, conventional poverty ratios applied in the past did not satisfy Sen's dictum, which eventually led to the development of a number of alternative poverty

measures that account for these axioms. A class of frequently used poverty measures is presented by Foster et al. (1984). Sen has been a consistent critic of the standard economics approach assessing 'economic' outcomes by identifying wealth, measuring GDP, happiness or basic needs (Sen 1993, 2009). Sen's contributions to poverty estimation embraces the concept of capabilities, which refers to individuals' options and choices to fulfil their potential. This absolute notion emphasizes the freedom to pursue achievements and participate in society, economy, and politics. It transcends comparisons and centres on individuals' purposeful capabilities. Several initiatives have been pursued to quantify multidimensional poverty (an insightful discussion can be found in Ravallion (2011)). Going beyond traditional income-based measures, the Oxford Poverty and Human Development Initiative (OPHI), has been at the forefront of pioneering research in multidimensional poverty measurement. In collaboration with the OPHI, Alkire and Foster have established the Multidimensional poverty index (MPI), accounting for multiple dimensions simultaneously, which allows a more nuanced and accurate assessment individuals' well-being. The United Nations Development Programme has conducted extensive research on multidimensional poverty, Anand and Sen's work (1994) on capabilities provides the theoretical foundation for the Human Development Index (HDI), which measures dimensions of human development in terms of health, education and living standard.⁶

Building on this foundation, a comprehensive comparison of various approaches to measuring multidimensional poverty using data from the 1995 Israeli Census was presented by Deutsch and Silber (2005). Most methods generally concur in identifying impoverished households. However, two exceptions, the distance function index and the fuzzy approach proposed by Vero and Werquin (1997), only partially identify various types of impoverished households, possibly due to redundant indicators. The study reveals consistent determinants of poverty, such as higher education levels of the household head leading to reduced poverty, while poverty fluctuates with household age and size. Single-headed households tend to have higher poverty rates, while married-headed households have lower rates. Additionally, poverty is influenced by factors like the religion of the household head, recent immigration status, employment status, and location. Further, the findings suggest that variables impacting multidimensional poverty align with those affecting poverty measured solely based on income or total expenditures. This indicates that even when income data is limited or unreliable, multidimensional poverty indices based on durable goods ownership can still offer valuable insights into poverty extents and determinants. Deutsch and Silber (2005) emphasize the importance of employing multidimensional

⁶ Both the German Federal government and the reporting on social standards in the EU refer to the capability concept in its annually issued poverty-report (Armut- und Reichtumsbericht).

poverty measures and shed light on economic distress in Israel. The authors demonstrate that such measures can serve as reliable alternatives when income data is problematic or unavailable, providing valuable tools for understanding and addressing poverty-related challenges. [Tkach and Gigliarano \(2022\)](#) highlight the role of dependence in poverty measurement, emphasizing the significance of considering existing interdependence when constructing composite indicators. Their article proposes a new multidimensional poverty index with dependence-based weights, accounting for interdependence among well-being determinants. The weighting method captures various types of dependence and asymmetry in joint extreme values. The elasticity of substitution between dimensions influences the trade-off among them. Applying the index to European countries, the study shows that multidimensional poverty decreased over the past decade. [Tkach and Gigliarano \(2022\)](#) conclude that higher weights for more interrelated dimensions lead to higher multidimensional poverty compared to equal weighting.

On the methodological side, we recognise analogies between our investigation and the methodologies employed by [Lovell et al. \(1994\)](#) in their research, particularly in terms of the adopted framework. [Lovell et al. \(1994\)](#) shed light on income inequality, the role of additional resources in shaping well-being, and the complexities in assessing poverty, emphasizing the importance of considering multiple dimensions of people's lives beyond income. The distance function, a concept widely used in Efficiency Analysis, has rarely been applied to the study of household behaviour, [Lovell et al. \(1994\)](#) made an initial attempt in this direction. Drawing upon Sen's notion of commodities, capabilities and functionings, the contribution of [Lovell et al. \(1994\)](#) revolves around the need for a satisfactory method to quantify and compare the material well-being of individuals and households. To achieve this, [Lovell et al. \(1994\)](#)'s work has three primary goals: firstly, to develop a measure that positions individuals according to their economic welfare, and secondly, to devise an index that assesses and ranks individuals based on their level of life satisfaction. Lastly, [Lovell et al. \(1994\)](#) creates an index that measures how proficient individuals are at converting their resources and capacities into functionings, which are outcomes or achievements in their lives. If the distributions of resources and capacities, as well as functionings, vary, this index of relative proficiency can help explain the differences. For example, if relatively deprived individuals show greater proficiency, it could lead to more parity in the functioning index compared to the index of capacities and resources. Instead of distinguishing between commodities and capabilities, [Lovell et al. \(1994\)](#) produce three scalar-valued indexes: an approximate Standard of Living index, which combines economic means; an approximate Quality of Life index, reflecting individual functionings and an approximate Transformation Efficiency index, indicating how effectively individuals convert economic means into functionings. To achieve

this, in accordance with [Dasgupta \(1990\)](#), who understands means and functionings as inputs and outputs within the context of household production, the authors use input and output distance functions, considering resources and functionings as inputs and outcomes, respectively. The advantage of using distance functions lies in their independence from the measurement units of constituent variables, avoiding the need for a priori weights or prices. In line with the stochastic frontier literature, the empirical analysis is carried out estimating the distance functions for both means and functionings. The data employed comprises 13 resources and 11 functionings, provided by 1069 participants in the Australian standard of Living study conducted 1987. The study's findings provide valuable insights into three key areas. Firstly, the disparity in household income after taxes, accounting for variations in household size and composition, surpasses the disparity seen in an approximate standard of living index that incorporates additional means beyond income. This inclusion of extra resources helps reduce inequality, which is a positive outcome. Secondly, the results reveal that the disparity in the standard of living index underestimates the inequity in individuals' quality of life. The distribution of means appears rather equal compared to the distribution of functionings, revealing significant disparities in people's actual well-being. Thirdly, the study highlights that individuals vary in their proficiency to convert resources into functionings, indicating differences in how effectively people translate their resources into well-being. This highlights the importance of considering not just the availability of resources but also their effective utilization in promoting well-being.

Overall, these studies emphasize the importance of considering multiple dimensions when estimating poverty and its determinants, resulting in more nuanced and accurate insights for researchers and policymakers alike. Previous studies concerned with household level vulnerability (e.g., [Skoufias and Quisumbing \(2005\)](#), [Ligon and Schechter \(2003\)](#)) have primarily relied on consumption theory. However, consumption is an aggregated measure of household achievements, we propose to dis-aggregate household level potential to multiple dimensions of household achievements.

3.2.3 Household's achievements

The subsequent section examines the importance of the three dimensions in reflecting household achievements, as identified in relevant scholarly literature.

Health

Sound health is fundamental to the individual and society, the covid-19 pandemic highlighted its importance for both society and the economy. However, it has also

revealed to affect individuals asymmetrically owing to the fact that a number of individuals exhibited better health continuance and safety compared to others. Health disparities and limited availability of health services within society are of particular concern when resulting in poor health, reduced life expectancy, premature illness and behavioural risks to health. Firstly, good health enables societal and economic participation and is likely to increase well-being as well as life satisfaction on the individual level. Secondly, on the societal level, earlier studies established that more equal and greater health outcomes are likely to reduce public spending, alleviate the pressure on healthcare systems, result in greater social cohesion and a reduction of crime. [Marmot \(2005\)](#) revisits the social determinants of health inequalities, examining cross national efforts to address social determinants of health, targeted policies and interventions.

The WHO European Health Equity Status Report (2019) outlines five essential conditions paving the way to health inequities, as follows: health services, income security and social protection, precarious living conditions, social and human capital, employment and working conditions. It is reported that more than half of the health inequalities in self-reported health in the EU are attributed to economic insecurities and housing conditions. Much research on health inequalities has demonstrated that there are significant disparities in health outcomes across different social and economic groups (e.g. [Blaxter 1987](#), [Muurinen and Le Grand 1985](#)). Numerous studies have documented a clear health gradient, where individuals from lower socioeconomic backgrounds, racial and ethnic minorities, and other marginalized populations are more likely to experience poorer health outcomes, such as higher rates of chronic disease, disability, and premature mortality (e.g., [Stringhini et al. 2017](#), [Lantz et al. 2005](#)).

Housing

To explore disparities in housing outcome inequalities, two key components are considered, affordability and housing conditions. Moreover, housing outcomes are contingent upon access to housing finance and housing market regulations. Access to adequate housing finance and affordable housing is critical to ensure that individuals and households can acquire and maintain housing that meets minimum standards of living conditions, which in turn plays a vital role in determining the overall health and well-being of occupants. Based on cross-sectional data from 13 EU countries, [Dewilde and De Decker \(2016\)](#) analyse how the capitalisation of housing regimes⁷

⁷ This refers to the ways in which power dynamics, ideological perspectives, and cultural norms shape the social, political, and economic structures that govern the provision, distribution, and use of housing [Kemeny \(1981\)](#).

influence housing statuses across distinct income and occupancy groups. The authors conclude that in countries with a more commercialized/monetized housing regime, poor individuals face more budget constraints but enjoy better housing conditions. Over time, low-income homeowners and private renters have faced worsening conditions compared to those on a middle-income, attributed to the rising capitalisation of housing, decreasing private rental supply, and unimproved housing conditions. According to [Dewilde and De Decker \(2016\)](#), the disparity in affordability between private renters with low- and middle-incomes notably expanded from 1995 to 2007, and this was not a consequence of reduced household incomes in the aftermath of the financial crisis. Hence, in countries with higher income inequality levels, low-income individuals residing in either private or rental housing, are more likely to experience overcrowding⁸ and lack adequate housing conditions. Additionally, differences in housing outcomes are the result of housing cost overburden, which relates monthly housing expenditure to income when this ratio exceeds 0.4. Another study by [Desmond and Wilmers \(2019\)](#) carried out in 2012 based on US Rental Housing Finance Survey, argues that exploitation of tenants, in the form of being overcharged relative to the residential market value, is most prevalent in economically disadvantaged neighbourhoods. Hence, landlords operating in relatively destitute locations, generate higher surplus by mitigating their financial risks at the expense of high rent burdens in low-income communities.

A significant research article highlighting the importance of housing conditions in influencing well-being outcomes was presented by [Cattaneo et al. \(2009\)](#). The study investigates the impact of physical housing conditions on subjective well-being measures. Applying a difference-in-differences technique the authors examine the impact of a large-scale programme that replaced dirt floors with concrete floors in a Mexican region. The results suggest improved child health outcomes, and higher subjective well-being of adults, evidenced by reduced levels on depression and perceived stress. Drawing upon longitudinal evidence, [Foye et al. \(2018\)](#) and [Zumbro \(2014\)](#) find a positive link between home-ownership and life satisfaction, the former is both a social norm and positional good, where [Zumbro \(2014\)](#) finds this to be particularly pronounced for lower income groups.

Another channel that could account for discrepancies in housing outcomes is the intergenerational transfer of home-ownership ([Thorns 1981](#)). According to [Henretta \(1984\)](#), the value of a parent's home is a reliable predictor of their child's future property value. In addition, the transfer of wealth from parents to children through inheritance provides financial support for housing, including rental support and down

⁸ Eurostat defines overcrowded households based on the min. number of rooms required, including provisions for couples, individuals aged 18 or older, same-gender adolescents (12-17 years), and pairs of children under 12 years.

payments. When estimating the housing achievement index in our analysis we account for the overcrowding rate as a measure of the occupants' dwelling quality.

Employment

In addition to the aforementioned dimensions that increase the exposure to vulnerability, the uneven distribution of employment arrangements results from individual level socioeconomic determinants and aggregate policies which manifests itself in an array of forms, such as wage differentials, disparities in job security and benefits, occupational segregation, work-life balance, skill relevance and upgrading as well as discriminatory practice in hiring and promotion. In recent years, labour markets have been shaped by significant shifts that bear economic insecurities (e.g., [Hacker \(2019\)](#)) such as the increase in unconventional job contracts, fixed-term and temporary work ([Kalleberg 2000, 2009](#)) coupled with the need to pursue supplementary/secondary employment to meet living costs. Simultaneously, the rise in single-parent families further places a burden on households' financial resources when the reliability on social welfare systems erodes as a consequence of social safety net retrenchment. A study carried out by [Schneider and Harknett \(2019\)](#), reveals that exposure to frequent change in work schedules is linked to psychological distress, poor sleep quality, and unhappiness. Although low pay is a significant contributor to these adverse outcomes, unstable schedules have a substantially stronger effect. The authors argue that unpredictable working hours are crucial to precarity and thus effecting overall well-being.

In the context of advanced economies, various aspects of employment vulnerability and adverse treatment have been examined. In this context, it is worth elaborating on the term 'precariat' ([Standing 2011](#)), which involves labourers facing flexible working contracts, temporary and part-time jobs or intermittent arrangements facilitated by employment agencies. However, their experience of instability goes beyond work-related characteristics. In addition, these individuals find themselves burdened with extensive administrative effort that lacks recognition and remuneration, leading to the absence of occupational identity. This includes constant retraining, networking and job search. Moreover, the precariat faces exploitation not only within the workplace but also in their personal lives, with low job security and limited access to compensation packages such as pensions or paid holidays ([Cappelli 2001](#)). Further, the precariat witnesses an erosion of civil, cultural, political, social, and economic rights. As a result, the precariat faces a profound sense of relative deprivation, anxiety, alienation, and anger exacerbated by income inequality and chronic economic uncertainty. Hence, the precarious nature and the collective consciousness of economic insecurity of these employment arrangements can have detrimental consequences on individu-

als' overall well-being (Eichhorst and Kalleberg 2023).

Based on EU Statistics on Income and Living Conditions, Sánchez-Mira and O'Reilly (2019) focus on household employment patterns in the aftermath of the 2008 crisis. The findings imply that dual earning households are the consequences of economic necessities rather than gender equality. Further, the study reports a revival of households where males predominantly take on the role of primary breadwinners, due to female unemployment. Simultaneously, an increase in the occurrences of single female earners and unemployed households has been noted. Bazillier et al. (2016) offers a country level aggregate employment vulnerability index as the sum of employer related and job related characteristics. They find that, self-employed workers are the most vulnerable in terms of employer vulnerability while the lowest job related vulnerabilities are found among, professionals and those holding leadership positions.

Although employment has become increasingly uncertain and polarised, the quantification of employment vulnerability on the household level remains unresolved.

3.3 Data

We move to briefly describe the data sources and variables used to construct aggregated household-level vulnerability indices. These indices are derived from individual-level reported data in Germany since 1985 and are employed in the empirical application. The data are compiled from SOEP (version 36), which provides both household and individual level data on personal characteristics, education, living arrangements, income, employment occupational and migratory history.⁹ Our analysis employs the latest available version of the data covering the period 1985-2019 covering a sample of 51,359 unique households.

Table 3.1 offers an overview of the descriptive statistics, providing key household resources as observed in the year 2017. Household resources include two metrics indicative of a household's financial well-being and its long-term housing affordability, an energy bill and rent-to-income ratio are computed. When the rent-to-income ratio exceeds one third, it typically signifies a heightened risk for households in meeting housing expenses, particularly in the face of external shocks. Consequently, these households, depending largely on their income, become more vulnerable to the risk of falling into poverty at some point in the future. The SOEP panel data set allows the distinction between a set of migration backgrounds. Hence those without any

⁹ The German Socio-Economic Panel (SOEP) is a longitudinal panel dataset and one of the largest and longest-running multidisciplinary household surveys conducted since 1985. Yearly, approximately 30,000 individuals in 15,000 households are interviewed.

personal or family migratory history are classified as 'native', those born in Germany with at least one parent born abroad, 'second generation migrant', and those with personal migration history 'foreign'.

To better understand how different household formations are impacted by vulnerability, we consider three possible combinations: native, non-native, and mixed households, which are outlined in Table 3.2. We refer to these as household types/groups interchangeably. The figures are based on a sample of 51,359 unique households. We assess potential differences between these household compositions by categorizing them into native (Type 1), non-native (Type 2), and mixed migration background households (Type 3). Due to data scarcity regarding households' energy expenditure, the energy-to-income ratio is not included in Table 3.1. Table 3.1 suggests similar average rent to income ratios across household types, the summary statistics however indicates a higher rate of at risk of poverty among foreign-households. The monetary risk of poverty applies to a disposable income of less than 60 percent of median household incomes. This risk of poverty cut-off is estimated and provided on an annual basis for single households and those exceeding two household members by the German Federal Statistical Office. According to the estimations (Table 3.1) the share of those households falling below the poverty line among all groups decreases with a household size larger or equal to two members.

Table 3.1: Descriptive statistics 2017

Population	Native	Foreign-born	2nd-generation
household income	45110	32029	43967
household size	2.7	3.6	3.5
percent living with children	33.65	60.37	55.44
living in overcrowded space	34.61	77.27	65.41
owner occupied	55.44	18.28	36.06
rent/income ratio	0.24	0.26	0.25
at risk of poverty*	18.25	35.63	16.9

Source: SOEP, v36; own weighted calculation, average household post-gov. income deflated by cpi, household size: number of household members

* threshold in €, cut-off 60 percent of median household income, household size > 1; monetary poverty

It is crucial to differentiate between distinct household formations. This distinction is particularly significant due to the observed rise in non-nuclear households. We address the variety in household formations comprehensively in our empirical estimation as presented in Section 4.5.

Due to limited data availability, societal participation has not been added to the estimation, since variables capturing frequency of social, physical activities and po-

litical participation are only available on a cross-sectional basis. Societal participation along with health, financial positioning and employment are crucial for household welfare.

Table 3.2 estimates the dynamics of household compositions in Germany, visualised in Figure 3.1 in five year intervals. The share of one-person households and those only formed by native individuals ('native') remain at a stable level over time. Non-native household refer to the case where all individuals within the household have some sort of migration background, either foreigners or second-generation migrants. A minor increase in non-native households is observed since 2015, explained by the migration wave starting from 2015 to Germany, at the same time the proportion of mixed households remains consistent.

Table 3.2: Household composition

Household composition	2000	2005	2010	2015
Share of single HH	0.25	0.26	0.20	0.23
Native	0.86	0.86	0.85	0.79
Non-Native	0.07	0.07	0.069	0.146
Mixed	0.07	0.07	0.081	0.064

Source: SOEP, v36; own weighted calculation; Figures reflect proportions based on 5-year averages.
 N = 51,359 unique HH (1984-2019), single HH without children

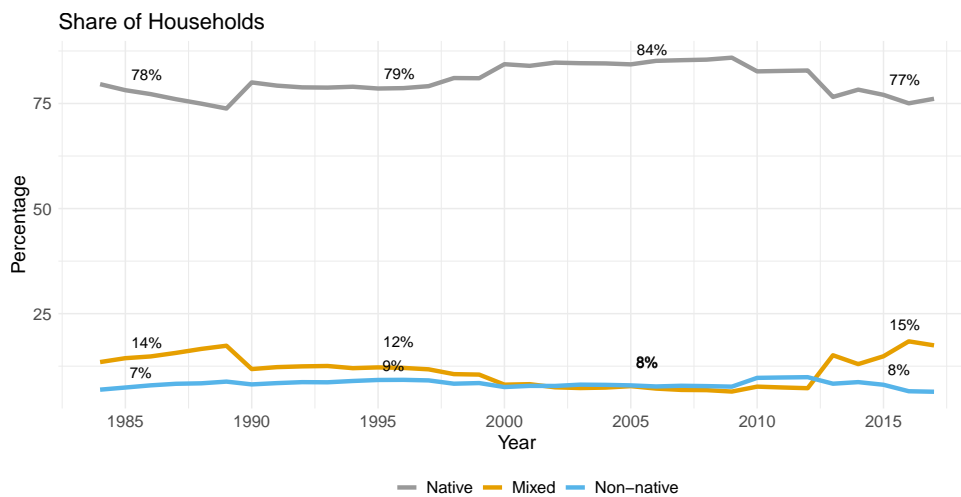


Figure 3.1: Household achievement: housing

Notes: data: SOEP, v36

3.4 Methods

The primary innovative methodological contribution of this paper lies in modeling vulnerability as the shortfall of a potential level of the multidimensional household capacity. The household possesses multiple resources, such as the disposable household income¹⁰, health, education, employment, housing condition, marital status, household size, number of children, rent-to-income (housing overburden rate) and energy-to-income ratios, home-ownership status as well as societal participation. The household employs these resources to maximise its housing, employment and health, with these dimensions being proxied through indices. Prior to aggregating these indices on a household level, the indices were computed on an individual level applying principal component analysis. To aggregate the individual health, employment and housing indicator to a household level, we chose the minimal individual-level achievement out of all household members for each indicator and assign these as the aggregate household health, employment and housing resources- since the shortfall in one of the mentioned indicators, likely decreases the by and large performance (well-being) of the entire household. More details are provided in section 3.4.2. The method proposed in this paper measures the underachievement of households in terms of housing, employment and health that contribute to welfare and reflect vulnerability about achievement of desirable outcomes.

The approach undertaken in this article is based on the insights of the utility gap concept discussed in Section 3.2. The implementation is broken down into two parts. First it is assumed that a household possesses some resources that it transforms into multidimensional achievements. The resources (also know as inputs) as well as the achievements (also know as outputs) will be discussed separately. Assume that the vector of inputs \mathbf{X} can be transformed into the vector of outputs \mathbf{Y} via some implicitly written transformation function $F(\mathbf{Y}, \mathbf{X}) = A$. The transformation function F can be made stochastic by assuming that $A = \exp(v)$ instead of the general premise that $A = 1$. While v is the usual symmetric error with an expectation 0, $\exp(v)$ is necessarily positive.

The second part of the implementation is that there is a gap between what a household achieves and what it can potentially achieve. Denote the achievement level by a scalar $0 < \theta \leq 1$, whereby a household achieves its potential if $\theta = 1$ and it is below its potential if $0 < \theta < 1$. The shortfall, gap, or underachievement between the observed and potential achievement will provide a measure of vulnerability.

¹⁰ To date, there remains little agreement among scholars as to what extent income is the first choice as an indicator for the standard of living. Instead, more recent literature regards household expenditure as the better indicator of welfare and living standard, (see [Noll and Weick \(2007\)](#) for a comparison on both indicators).

Then the transformation function can be expressed as

$$F\left(\frac{\mathbf{Y}}{\theta}, \mathbf{X}\right) = \exp(v).$$

The well-behaved transformation function is homogeneous of degree 1 in outputs, implying that

$$F\left(\lambda \frac{\mathbf{Y}}{\theta}, \mathbf{X}\right) = \lambda \exp(v), \quad (3.1)$$

with λ being some positive scalar. Setting $\lambda = y_1^{-1}\theta$, (3.1) becomes

$$F\left(\frac{\mathbf{Y}}{y_1}, \mathbf{X}\right) = y_1^{-1}\theta \exp(v), \quad (3.2)$$

where $\mathbf{Y}/y_1 = (1, y_2/y_1, \dots, y_M/y_1)$. Denoting $\mathbf{Y}_{-1} = (y_2/y_1, \dots, y_M/y_1)$, and applying logarithm transformation, (3.2) can be written as

$$\log f(\mathbf{Y}_{-1}, \mathbf{X}) = -\log y_1 + \log \theta + v, \quad (3.3)$$

where $f(\mathbf{Y}_{-1}, \mathbf{X}, \beta) = F(1, \mathbf{Y}_{-1}, \mathbf{X})$ is the parametric function with technology parameters β . Using the $\theta = \exp(-u)$ notation, where $u \geq 0$ is underachievement, yields the composite error IO transformation function, which is also known as the stochastic output distance function. Operationalization of the concept can be traced to a familiar stochastic frontier framework (introduced by [Aigner et al. 1977](#), [Meeusen and van den Broeck 1977](#)) by writing (3.3) as¹¹

$$-\log y_1 = \log f(\mathbf{Y}_{-1}, \mathbf{X}, \beta) + u + v, \quad (3.4)$$

where the error term v is assumed to be a normally distributed random variable, whereas underachievement u is usually assumed to have an exponential or half-normal distribution.

3.4.1 Determinants of (under)achievement

The interest of the empirical application lies not only in quantification of vulnerability but also explaining it. The determinants of u are introduced via the variance following [Reifschneider and Stevenson \(1991\)](#), [Caudill et al. \(1995\)](#),

$$u_i \sim N^+(0, \sigma_{u_i}^2) \text{ where } \sigma_{u_i}^2 = \exp(\mathbf{z}_i\gamma), \quad i = 1, \dots, n, \quad (3.5)$$

¹¹ It does not matter if we write $-v$ or v since v is symmetric error with an expectation of 0.

and z_i is the vector of covariates that explain underachievement. Since $E(u_i) = \sqrt{(2/\pi)}\sigma_{u_i} = \sqrt{(2/\pi)} \exp(0.5z_i\gamma)$, the z_i variables are not only determining the heteroskedasticity of underachievement but underachievement itself. Consider a marginal effect of a variable z_1 on underachievement, which is the underachievement change (UC) due to change in z_1 holding everything else fixed. Since the underachievement is $\exp(-u_i)$, the rate of change in it due to a change in z_1 (labeled as UC) is given by

$$\text{UC} \equiv \Delta u_i = -\frac{\partial u_i}{\partial z_{1i}} \approx -\frac{\partial E(u_i)}{\partial z_{1i}} = -\sqrt{\frac{2}{\pi}} \frac{\partial \sigma_{u_i}}{\partial z_{1i}}. \quad (3.6)$$

Under the assumption (3.5), (3.6) can be written as

$$-\sqrt{\frac{1}{2\pi}} \frac{\partial (z_i\gamma)}{\partial z_{1i}} \exp(0.5z_i\gamma). \quad (3.7)$$

3.4.2 Principal component analysis

Along with the multidimensional vulnerability estimation, the second contribution of this study is the aggregation of individual-level survey response data to the aggregate household level. Three household resources, namely health, housing, and employment, are formulated as composite indices at the individual household member level, these are subsequently aggregated to the collective household level. The following introduces the principal component analysis applied to compose individual level indices in greater detail.

To create three distinct indices capturing the maximum variance explained and to assess the number of components required to achieve this, screeplots as illustrated in Figures 5.6, 5.8, 5.7 (Appendix B) were generated. These visual representations illustrate the magnitude of eigenvalues or the explained variances associated with each principal component. By observing the scree plots, we aim to determine the optimal number of principal components to retain in the analysis.

There are several criteria to ascertain the required number of retained components that capture most of the variability in the data. Firstly, according to the widely recognised 'rule of thumb', the number of principal components retained is determined by considering those components that lie above the 'scree' in the plot. These retained components are the ones that significantly contribute to capturing the maximum variance in the data. By employing this approach, we aimed to ensure the selection of the most meaningful and influential components for the subsequent construction of the distinct indices representing the health, housing, and employment domains. Collectively, the screeplots indicate that a single component would suffice to capture the variability of the selected items. Secondly, eigenvalues serve as a crucial criterion for

selecting the number of principal components to retain in the PCA. The eigenvalue matrices play a substantial role in determining the proportion of variance accounted for by each principal component. Larger eigenvalues correspond to principal components that capture a higher amount of variance in the data, implying their greater significance in dimensionality reduction and data representation. Moreover, eigenvalues > 1 are particularly informative as they exceed the average contribution of a single item, enhancing their relevance in the analysis. The sum of the eigenvalues is equal to the number of items, making eigenvalues greater than 1 more indicative of substantial information retained by the corresponding principal components. By examining the eigenvalues, the relative importance of each principal component in capturing the data's variation can be determined. Principal components with larger eigenvalues carry greater influence and should be retained in the analysis, while those with smaller eigenvalues may have limited contributions and could be excluded in dimensionality reduction. Based on the eigenvalues illustrated in Table 3.3, it can be inferred that one principal component is sufficient for each domain.

In PCA, the principal components are calculated by combining the original variables in a way that captures the most significant data variance patterns. The item loadings, representing the coefficients, reveal the relative importance of each original variable in shaping these principal components. When the absolute values of item loadings are higher, it indicates that the corresponding variable exerts a stronger influence on the specific principal component.

These item loadings hold vital importance in the interpretation of PCA outcomes. They provide valuable insights into which variables demonstrate stronger associations with specific principal components, thereby shedding light on the key variables that contribute significantly to explaining the variance within the dataset.

A PCA was carried out to discern underlying patterns of variance and identify the key variables influencing the three distinct domains: health, housing, and employment. The PCA results, presented in Table 3.4, shed light on the relationships between the original variables and the principal components, revealing significant insights for each index/domain.

Within the health domain, it can be observed that the variables *self-rated health*, *health satisfaction*, and *disability* status demonstrate relatively high positive loadings of 0.873, 0.859, and 0.598, respectively, on the first principal component (PC₁). This suggests that these variables have a substantial impact on shaping the dominant pattern of variance within health-related data. Conversely, variable *difficulties with housework* exhibits a comparatively lower loading of 0.423, indicating a weaker association with the primary health component.

In the housing domain, variables *housing overcrowding*, *housing adequacy*, and *bad space* exhibited high positive loadings of 0.86, 0.707, and 0.841, respectively, on PC₁,

signifying their crucial role in influencing the primary housing component. However, the variable *housing condition* displays a smaller loading of 0.3 on PC₁, suggesting a relatively lower impact on the overall housing pattern.

Turning the focus to the employment domain, it is found that *precarious work* and *employment status* display substantial positive loadings of 0.966 and 0.967, respectively, on the first principal component. These results indicate that these variables significantly contribute to shaping the main employment-related variance. Conversely, the variable 'second job' exhibits a weak loading suggesting no crucial association with the particular principal component and the loading on 'hourly wage', close to zero implies no significant association on the component.

In addition, the sum of squared (SS) loadings for each domain (2.205, 2.035, and 1.869 for Health, Housing, and Employment, respectively) provides a quantification of the amount of variance in the original variables that is explained by its corresponding principal components. Higher SS loadings indicate that the primary components capture a greater portion of the original variables' variance. The percentage of variance explained by a principal component is determined by dividing its respective eigenvalue by the overall sum of eigenvalues, corresponding to the total variance. Further, the proportions of explained variance values, suggest that the health index explains 0.441 percent of the total variance in the data set, the housing index explains 0.509, and 0.623 by the employment domain respectively.

Table 3.3: Eigenvalue Matrices for three domains

Health					Housing				Employment			
2.2045	0	0	0	0	2.0351	0	0	0	1.6233	0	0	0
0	0.9537	0	0	0	0	0.9705	0	0	0	1.0115	0	0
0	0	0.8868	0	0	0	0	0.6616	0	0	0	0.9869	0
0	0	0	0.7276	0	0	0	0	0.3327	0	0	0	0.3782
0	0	0	0	0.2273								

Note: The five eigenvalues represent the scaling factors associated with the corresponding eigenvectors. Each eigenvalue carries important information about the magnitude of variance, importance ranking, and the variance of the principal components.

$\sum \lambda_i = \sum \text{Var}(PC_i)$, where λ_i denotes the eigenvalues and PC_i represents the principal components; the total sum of the eigenvalues is equal to the sum of the variances of the original variables.

Table 3.4: PCA Results

Principal Component Analysis			
Loadings	Health	Housing	Employment
self-rated health	0.873		
disability	0.598		
difficulties w. housework	0.423		
health satisfaction	0.859		
freq. of exercise	0.409		
housing adequacy		0.707	
housing condition		0.300	
overcrowding		0.860	
bad space		0.841	
precarious work			0.899
employment status			0.897
second job			0.101
hourly wage			-
SS Loadings	2.205	2.035	1.623
Proportion of Variance explained	0.441	0.509	0.406

Note: SS Loadings stands for *sum of squared loadings*. The loadings on 'hourly wage' are close to zero.

Table 3.5: KMO and Bartlett's Test for PCA analysis

	Health	Housing	Employment
Kaiser-Meyer-Olkin Measure of sampling adequacy	0.64	0.64	0.74
Bartlett's Test of sphericity			
Chi-square	381910.1	659909.05	174099.40
p	< 0.001	< 0.001	< 0.001

Note: Bartlett's test of sphericity tests whether there is sufficient significant correlation in the data to conduct PCA analysis. A score of 0.5 is suggested as the minimum KMO score to perform PCA.

To assess the adequacy of the PCA a measure of sampling adequacy and the Bartlett's sphericity test are carried out and reported in Table 3.5. The overall Kaiser-Meyer-Olkin 'measure of sampling adequacy' (MSA) of the items accounted for in the household level health and housing equal 0.64 and employment 0.74 respectively. Kaiser (1970) suggests a MSA $>.50$ as the lower limit, however a MSA of .80 or higher would be desirable. Current practice suggests that the KMO score should be .60 or above to continue with the factor analysis, hence the chosen items (current self-rated health, satisfaction with health, disability status, dummy housework difficult alone, frequency of exercise) are appropriate to proceed. The Bartlett's sphericity test assesses whether the correlations between variables exceed what would be expected by random chance. It essentially examines whether the correlation matrix can be considered an identity matrix. A significant p-value in this test indicates that the null hypothesis, suggesting all off-diagonal correlations to be zero, is rejected, thereby implying meaningful associations between the variables. In sum, the KMO values exceeding 0.6 demonstrate that the data in all three domains are appropriate for conducting PCA analysis. Further, the significant p-values derived from Bartlett's Test provide evidence of meaningful correlations among the variables within each domain. These findings confirm the suitability of employing PCA for the subsequent analysis and dimensionality reduction, enhancing the robustness and validity of the conducted vulnerability analysis.

Housing

We define a housing indicator, households' achievements in terms of housing conditions, that households strive to maximise. Following a thorough selection of housing related survey data, incomplete responses have been omitted from the empirical application/ analysis to ensure the housing vulnerability index accounts for the full range of housing related variables. Firstly, an overcrowding index, in line with the current literature (e.g., Cable and Sacker (2019)) is estimated and defined in the case where the occupation per room within a dwelling except for the kitchen and bathroom exceeds 1. Further, we generate a dummy variable called, 'bad space condition', being true when the overcrowding index is greater than 1.4, suggesting bad space utility per person if there are more than 1.4 individuals occupying a single room. No distinction is made between single and double rooms, a room in line with SOEP data description, is a space larger than 6 sqm. In Germany, there is a consistent trend of per capita living space expansion, as noted by Weber (2020). Further, akin to Frick (2004) our proposed housing index, captures individuals' evaluation of the adequacy of living space in a housing unit, ranging from *much too small* to *much too large* and the evaluation of the housing condition, from *dilapidated* to *good condition*. Both variables

are available on an individual response Likert scale. Figure 3.2 shows the housing achievement distribution by household types.

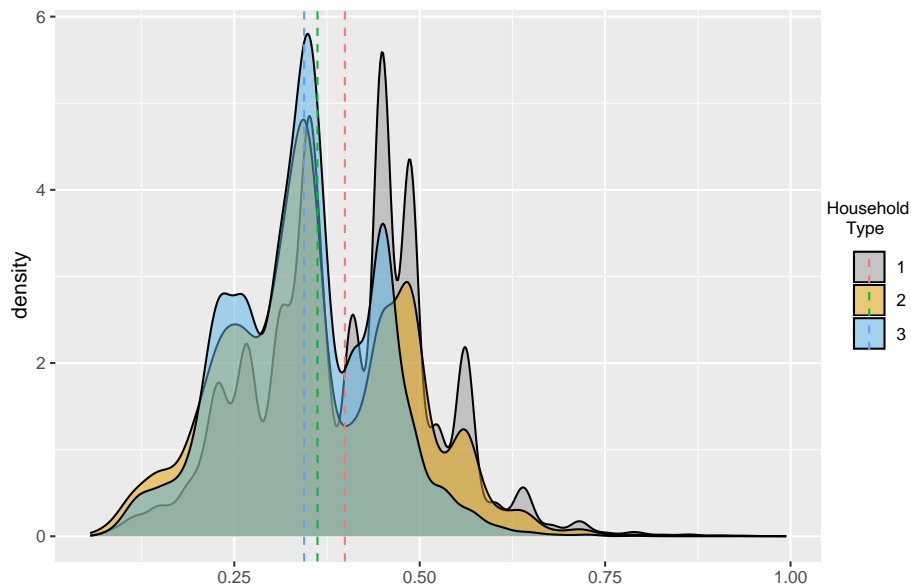


Figure 3.2: Household achievement: housing

Notes: type1: native hh; type2: non-native; type3: mixed

Employment

Economic shocks significantly impact labour markets (e.g., [Shin \(1997\)](#), [Huckfeldt \(2022\)](#)) and consequently affect households' well-being ([Deaton 2008](#)). The employment status/achievement of household members traditionally represents the primary source of household income and the degree of societal participation. Households with a greater share of unemployed working age members are at a greater financial risk when exposed to economic uncertainty and more vulnerable to external shocks and consumption smoothing (e.g., [Kamanou and Morduch \(2002\)](#), [Ligon and Schechter \(2003\)](#)). Since the entire household is likely to witness deprivation and a decrease in well-being with a change of the employment situation of one of the household members ([Dynarski and Sheffrin 1987](#)), an aggregate employment achievement indicator is proposed considering the household-level dimension.

The constructed employment achievement index on the household level is an oversimplification defined by: weekly hours worked, employment level (not working, part-time, full-time) as well as engaging in secondary employment in addition to the main occupation. Note, due to data paucity on the longitudinal level (annually reported data 1984-2019 for the estimation of the output distance function required), an array of relevant items to distinguish employment achievements across households has not been accounted for. On the employment level, considering not working

individuals, there are plentiful reasons for non-participating in the labour market (a conceptual framework is presented by Taylor (2004)). Reasons for 'not working' apart from being out of working age is not provided in the data set in a longitudinal perspective, hence it is challenging to decide whether 'not working' represents one's vulnerability, wealth, deliberate non-participation in the labour market or inheritance. While employment vulnerability refers to the precariousness or insecurity experienced by individuals in their work arrangements (Kalleberg 2009), the decision not to engage in paid work are manifold. In the case of deliberate exclusion from the labour market, the term 'precarity' may be inappropriate. Inadequate adherence with workplace standards related to fairness, safety, and employee well-being can result in a lack of decent and adequate working conditions, consequently elevating the risk of experiencing employment vulnerability. Taking into account the national minimum wage of € 9.19 (as of January 2019) and an at-risk-of-poverty threshold for a single individual in 2019, set at € 14,109 annually ($€ 9.19 \times 40 \text{ hrs} \times 50 \text{ weeks} = € 19,115.2$; $14,109 / 19,115 = 0.74$), we can determine that working less than 74 percent of a 40-hour work week (which is 29.6 hours or approximately 30 hours) increases the vulnerability to experiencing poverty in the future.

Working long hours (e.g., > 40 hrs weekly) could indicate both, precarity (having one full time job and a secondary job to cope with living expenditure, temporary contracts or gig economy jobs) or a high degree of responsibility within the occupation, coupled with the need to monitor processes and no possibilities to delegate tasks. Extended periods of work without adequate rest and recovery contribute to vulnerability in several ways, diminishing returns to productivity and efficiency, physical and mental exhaustion, disruption of a work-life balance. In specific industries there can be a prevailing expectation or pressure to put in long hours as a means of career advancement. This situation can lead to vulnerability, as individuals may feel compelled to compromise their personal well-being and work excessively in order to meet the high professional standards and expectations.

Hence, based on the reported hours worked annually, the number of hours worked weekly is calculated and a dummy variable is generated (1= works less than 30 hrs weekly, thus vulnerable to fall below at risk of poverty threshold & 0=works more than 30 hrs). In line with the German legislation (§ 3 Abs. 1 Arbeitszeitgesetz), working hours must not exceed 48 hours per week. Up to 60 hours can be extended if an average of 48 hours per week is not exceeded within four calendar months or 16 weeks. Consequently, all arbitrary responses indicating working more than 60 hours and some outliers even 140 hrs weekly have been treated as non-response. Figure 3.3 shows the employment achievement distribution by the type of migration.

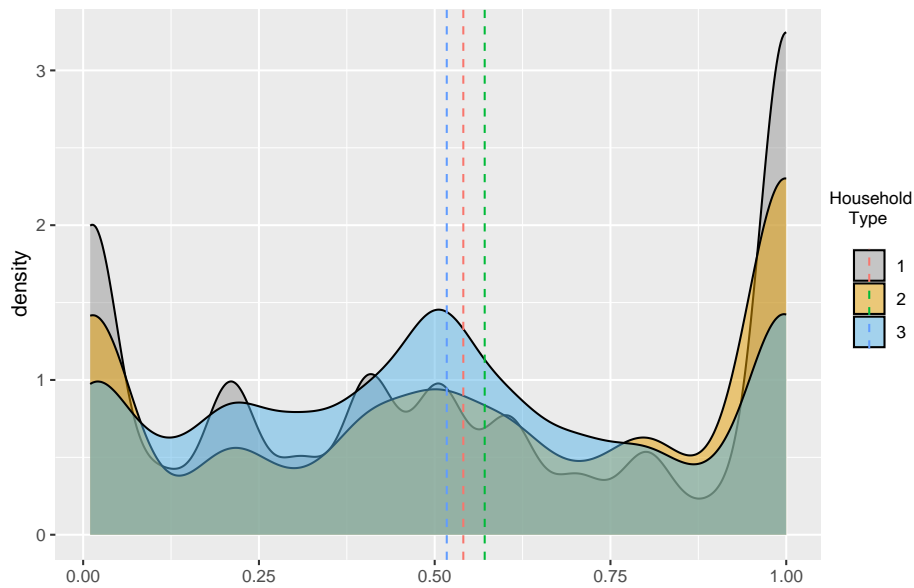


Figure 3.3: Household achievement: employment

Notes: type1: native hh; type2: non-native; type3: mixed

Health

The proposed health index is generated on reported individual level health data. Due to data paucity on the longitudinal level, several salient health parameters such as mental health have not been included to obtain the empirical results (Section 4.5), it is merely a oversimplified construct reflecting health measures that are available in the data set. Mental health possesses both intrinsic and instrumental importance, evidence on its economic effects is presented by [Bhat et al. \(2022\)](#) and [Lund et al. \(2022\)](#). Its crucial role in overall well-being has become particularly apparent during the pandemic ([White and Van Der Boor \(2020\)](#), [O'Connor et al. \(2021\)](#)). We include self-reported data on physical health: individual disability status, satisfaction with health, frequency of exercising, current self-rated health status, along with a dummy variable on to the event of an individual experiencing difficulties to manage household chords alone. In a second step we aggregate the individual health indices to an aggregate household level health indicator selecting the minimum health attainment among household members. This approach acknowledges that a deficiency in the health of one household member can to some extent impact the overall household achievement. Compiling health from an individual-level to the household level and choosing the minimum across members, may introduce a bias ([Mikolai et al. 2020](#)) favouring larger households in the occurrence of a lower health achievement compared to those with fewer members. Figure 3.4 shows the health achievement distribution by the household type.

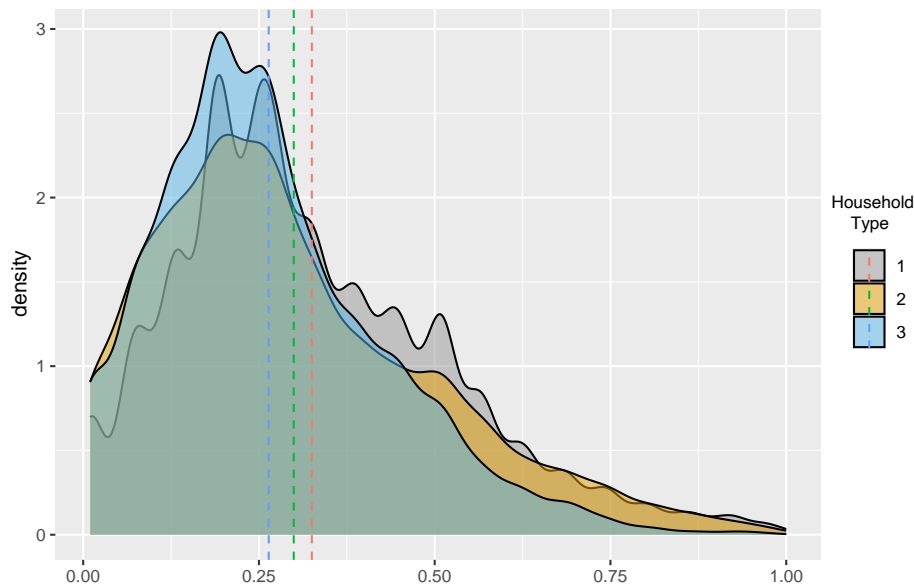


Figure 3.4: Household achievement: health

Notes: type1: native hh; type2: non-native; type3: mixed

3.5 Empirical Results

The analysis of households' potential and the identification of its shortfalls provides valuable insight into determinants of experienced vulnerability on the household level, which is the starting point of well-informed vulnerability alleviation programmes. This section presents the results of the proposed multivariate method applied to German household data. First, we introduce the distribution of household potentials followed by an inspection of the health, housing and employment achievements which are components of the household production function, resulting from corresponding household potentials. In the next stage, determinants of the shortfall from the overall household potential and their causes are examined in the context of vulnerability exposure.

3.5.1 Multidimensional vulnerability

Figure 3.5 provides an overview of the realised household potentials considering the entire population and enables the identification of those households that do not succeed in reaching their full potential. The x-axis represents the household potentials, ranging from 0 to 100 percent while the y-axis indicates the density or frequency of households at different potential levels. The plot helps identify households that fall short of reaching their full potential (100 percent). We therefore suggest that those households falling short on their potential, exhibit greater vulnerability in multiple dimensions subject to the 'household production inputs'. The dispersion of poten-

tials reveals an average household achievement of 92 percent. While the average household potential is relatively high, the left-skewed distribution of potentials with a rather long tail implies that a considerable number of households achieves a household potential below 60 percent.

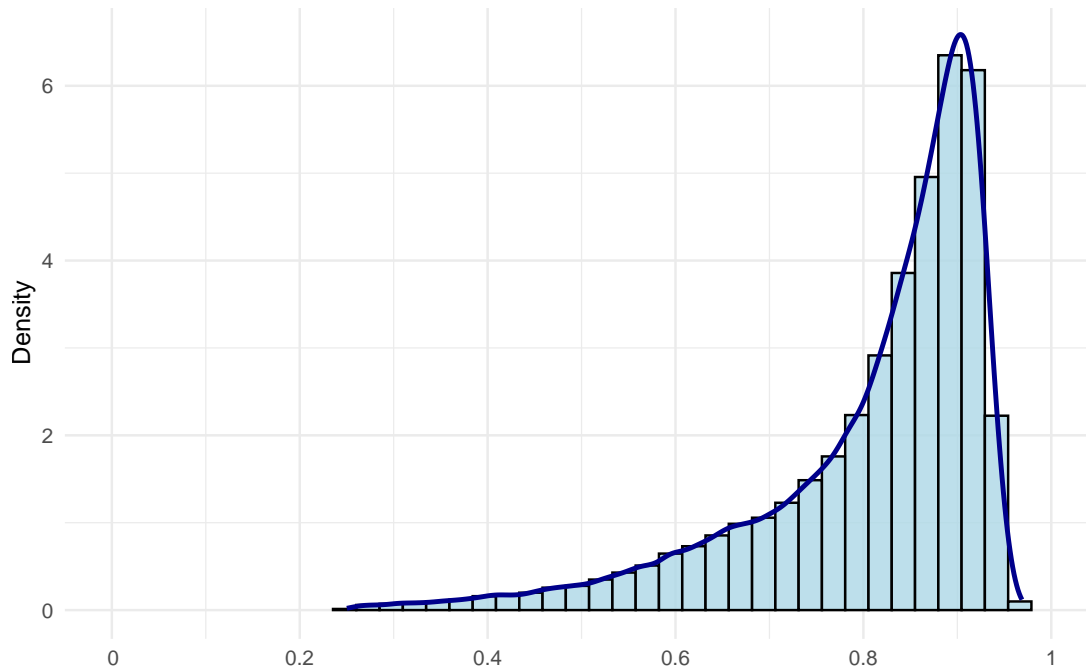


Figure 3.5: Household potential

Notes: Distribution of households' shortfall from their potential in percent, $N=78,279$.

Based on data released by the [Federal Statistical Office](#) in Germany in 2020 and in accordance with the more recent literature focusing on the German context (e.g., [Giesecke et al. \(2017\)](#), [Janßen and Bohr \(2018\)](#)), having a migration background is correlated with a higher vulnerability to expected poverty when compared to the native population. Notably, there are variations in the risk of poverty across different educational levels, with lower levels corresponding to higher risks of anticipated poverty.

To explore heterogeneity across household types, Figure 3.6 compares the dispersion of household potentials across the three types consequently. The figure reveals that on average native and mixed-households reach a marginally higher household potential, given available household resources compared to non-native households. To further examine the causes of the obtained differentials in realised household potentials, we now move to analyse the distribution of health, employment and housing achievements in accordance with the in Section 3.4.2 specified indices across the three distinguished household types. It should be recalled that we consider the minimal household achievement based on all household members.

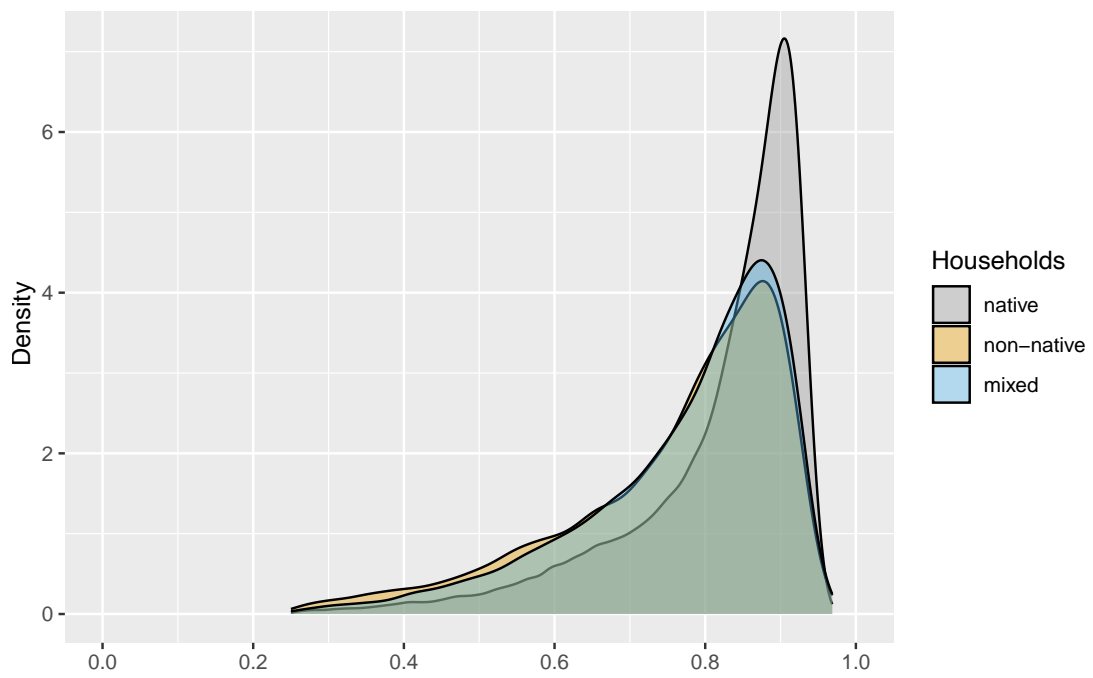


Figure 3.6: Household potential by household type

Notes: Distribution of households' shortfall from their potential.

The dispersion obtained from the preliminary analysis of the minimum household achievement in terms of employment is set out in Figure 3.3. The distribution of household achievements across all three household types follows a similar pattern. The highest concentration of employment accomplishments is found by the index bounds (0 and 1) along with observed peaks in the density plot at 0.175 and 0.5. No sizeable differences across groups are discernible apart from a more pronounced polarisation in employment achievements within native households and a greater proportion of mixed households attaining the 0.5 benchmark. In addition, a greater proportion of non-native households is situated within the lower half of the distribution. Next, accounting for health achievements, highlighted in Figure 3.4, minor deviations within the distribution across the three groups are noted. The average minimal achievement on the household level across the entire population amounts to 0.2, suggesting that households at least reach 20 percent of their health potential. Exhibiting a right-skewed pattern, no significant differences are observed among different household types. However, native households exhibit more pronounced minor peaks within the distribution. In Figure 3.2, there is a trend towards significantly higher housing achievements among the native population. Several peaks are observed, with more native households realising achievements beyond 0.5. The proposed household achievement index, includes estimations on the over-crowding of dwellings. Since we do not distinguish between age cohorts, the mere comparison of household types suggests that generally more space and better housing conditions are available in dwellings occupied by natives. Disparity in housing conditions and sizes between native and non-native households can be attributed to various determinants, such as economic advantages. Native households theoretically have an extended credit history, which could grant them improved access to credit, and hence the means to afford more favourable housing options. In contrast, particularly immigrants may face limited access to financial resources and social welfare, which can result in poorer accommodation. Going beyond the contribution of our analysis, demographic trends indicate that Germany is progressing towards an aging society, while a significant proportion of migrants predominantly fall within the younger age cohorts. Theoretically, the native population is more likely to possess a higher availability of spare rooms per dwelling, owing to for example, grown-up children leaving their households. Conversely, migrants, who often belong to the younger cohorts and reside with dependent family members, may encounter copious bureaucratic and linguistic barriers, which predictably coincides with worse housing achievements. Table 3.6 shows the estimates of the household production resources and subsequently. Since the stochastic frontier analysis has been carried out on various household living arrangements, table 3.6 provides parameter estimates for every sample respectively. The logarithmic transformation in this context renders coefficients non-

informative. When both the dependent and independent variables undergo log transformations, the coefficient signifies constant elasticity. Likewise, when the right-hand side variable is continuous, such as education and not transformed, the coefficient indicates semi-elasticity. As a result, these transformations reduce the meaningfulness and informativeness of coefficients' interpretation.

Table 3.6: Parameter estimates of the stochastic frontiers

	Parameter Estimate (z-value)				
	Full Sample	Single HH	Single Parent	Couples w/o child.	Couples 1-3 child.
(Intercept)	-0.1613 (-3.84)***	1.2040 (20.83)***	0.4060 (4.23)***	1.4043 (21.29)***	1.4195 (12.23)***
Log(housing/employment)	0.8680 (608.45)***	0.9284 (473.19)***	0.8629 (255.88)***	0.9287 (437.19)***	0.8348 (318.77)***
Log(health/employment)	0.0885 (65.06)***	0.0747 (38.15)***	0.0866 (25.42)***	0.0688 (33.22)***	0.1023 (49.54)***
Log(income)	0.1073 (45.82)***	-0.0667 (-18.31)***	0.0385 (5.15)***	-0.0699 (-18.40)***	-0.0402 (-8.34)***
year1994	-0.0164 (-2.50)***	0.0301 (2.77)**	0.0117 (0.50)	0.0179 (1.88)	-0.0034 (-0.35)
year1995	-0.0158 (-2.43)***	0.0442 (4.10)***	0.0231 (0.99)	0.219 (2.33)*	-0.0031 (-0.32)
year1996	-0.0285 (-4.39)***	0.0448 (4.23)***	0.0214 (0.54)	0.0265 (2.87)**	-0.0082 (-0.84)
year1997	-0.0392 (-6.00)***	0.0594 (5.63)***	0.0248 (1.12)	0.020 (2.51)*	-0.0232 (-2.37)*
year1998	-0.0457 (-7.09)***	0.0628 (6.12)***	-0.0082 (-0.37)	0.0249 (2.73)**	-0.0282 (-2.89)**
year1999	-0.0578 (-8.95)***	0.0613 (6.00)***	-0.0251 (-1.15)	0.0228 (2.52)*	-0.0370 (-3.75)***
year2001	-0.0816 (-13.67)***	0.0530 (5.62)***	-0.0255 (-1.25)	0.0152 (1.79)	-0.0403 (-4.35)***
year2003	-0.1028 (-17.06)***	0.0498 (5.28)***	-0.0113 (0.56)	0.0081 (0.95)	-0.0503 (-5.25)***
year2005	-0.1160 (-18.99)***	0.0482 (5.09)***	-0.0266 (-1.30)	0.0053 (0.61)	-0.0583 (-5.96)***
year2007	-0.1298 (-21.22)***	0.0456 (4.83)***	-0.0444 (-2.17)*	-0.0055 (-0.63)	-0.0636 (-6.42)***
year2008	-0.1338 (-21.58)***	0.0497 (5.24)***	-0.0485 (-2.35)*	-0.0016 (-0.19)	-0.0623 (-6.10)***
year2009	-0.1304 (-21.36)***	0.0498 (5.31)***	-0.0378 (-1.85)	-0.007 (-0.08)	-0.0545 (-5.42)***
year2011	-0.0797 (-13.71)***	0.0484 (5.12)***	-0.0287 (-1.55)	0.0024 (0.27)	-0.0177 (-1.99)*
year2013	0.1050 (-18.07)***	0.0443 (4.78)***	-0.0275 (-1.49)	-0.0014 (-0.17)	-0.0188 (-2.06)*
year2015	-0.1076 (-18.41)***	0.0517 (5.55)***	-0.0372 (-1.98)*	0.0002 (0.02)	-0.0121 (-1.33)
<i>Education</i>					
Inadequately completed	-0.0886 (-2.43)*	-0.0445 (-0.90)	0.0704 (1.13)	-0.0018 (-0.03)	0.0373 (0.35)
General Elementary School	-0.1756 (-4.90)***	-0.1068 (-2.19)*	0.0290 (0.48)	-0.0124 (-0.22)	0.0137 (0.13)
Basic Vocational Training	-0.190 (-5.32)***	-0.0960 (-1.97)*	0.0155 (0.26)	-0.0291 (-0.52)	-0.0273 (-0.26)
Intermediate General Qualification	-0.0686 (-1.91)	-0.0429 (-0.87)	0.0041 (0.07)	-0.0109 (-0.20)	-0.0113 (-0.11)
Intermediate Vocational	-0.0992 (-2.78)**	-0.0451 (-0.92)	0.0227 (0.38)	0.0290 (0.52)	0.0093 (0.09)
General Maturity Cert.	-0.0464 (-1.29)	0.0030 (0.06)	0.0048 (0.08)	0.0518 (0.93)	0.0041 (0.04)
Vocational Maturity Cert.	-0.0977 (-2.72)**	-0.0235 (-0.48)	0.0414 (0.68)	0.0271 (0.49)	0.0108 (0.10)
Lower Tertiary Education	-0.1675 (-4.66)***	-0.0483 (-0.99)	0.0373 (0.61)	-0.005 (-0.01)	0.0147 (0.14)
Higher Tertiary Education	-0.1679 (-4.68)***	-0.0284 (-0.58)	0.0283 (0.46)	0.0305 (0.55)	0.0232 (0.22)
$\sum_{i=1}^N T_i$	77,647	23,748	8,532	20,697	23,218

Note: Income is the household post-gov income. Due to data paucity, there are insufficient observations for several household compositions on the rent to income ratio and minimal household housing status. Other combination includes multi-generation households. For education, the reference group is 'in school'.
 $N=1,452$ households with other household configurations have not been separately analysed, these are accounted for in the full sample.

* p < 0.05 ** p < 0.01 *** p < 0.001

Table 3.7: Vulnerability component

Vulnerability component	Estimate (z-value)				
	Full Sample	Single HH	Single Parent	Couples w/ child.	Couples+ 1-3 child.
(Intercept)	15.1394 (11.25)***	58.5950 (21.70)***	24.9218 (3.90)***	44.8897 (12.49)***	27.9084 (6.09)***
Non-native-hh	-0.9421 (-0.28)	-2.9296 (-0.43)	-14.0610 (-0.98)	32.5126 (1.95)	-9.8301 (-0.88)
Mixed-hh	1.5660 (0.32)	-	-18.2232 (-1.21)	6.3221 (0.80)	-24.5997 (-1.96)
Log(income)	-2.9320 (-10.89)***	-11.1685 (-20.10)***	-4.7750 (-3.69)***	-8.1341 (-11.62)***	-4.9559 (-5.62)***
$0.5 \times (\log(\text{income}))^2$	0.2590 (9.58)***	1.0326 (17.98)***	0.4291 (3.26)**	0.7111 (10.40)***	0.4156 (4.89)***
<i>Federal States</i>					
2	0.1021 (1.94)	0.4839 (5.83)***	0.4165 (2.67)**	0.2968 (2.84)**	0.4158 (3.73)***
3	-0.2068 (-4.90)***	-0.2905 (-3.97)***	-0.2068 (-1.78)	-0.4198 (-5.05)***	-0.1364 (-1.62)
4	-0.0794 (-1.14)	-0.2938 (-2.55)*	0.5311 (3.14)**	-0.1104 (-0.80)	0.3153 (2.02)*
5	-0.0663 (-1.73)	-0.0895 (-1.37)	-0.0235 (-0.22)	-0.1383 (-1.83)	-0.0084 (-0.11)
6	0.0906 (2.14)*	0.1719 (2.29)*	0.3277 (2.70)**	-0.0414 (-0.50)	0.3579 (4.30)***
7	0.0068 (0.15)	0.2397 (2.94)**	-0.0152 (-0.12)	-0.1298 (-1.43)	-0.0618 (-0.67)
8	0.0612 (1.52)	0.0916 (1.33)	0.1700 (1.54)	0.0318 (0.39)	0.1515 (1.90)
9	0.0555 (1.40)	0.3454 (5.09)***	0.0806 (0.74)	0.2035 (2.60)**	0.1668 (2.08)*
10	-0.1063 (-1.21)	-0.4229 (-2.81)**	-0.4889 (-2.04)*	0.0142 (0.08)	0.0223 (0.13)
11	0.0160 (0.38)	0.2218 (3.15)**	0.3845 (3.27)**	-0.1190 (-1.42)	0.0631 (0.73)
12	-0.0651 (-1.44)	-0.4848 (-5.99)***	-0.0885 (-0.72)	-0.5959 (-6.77)***	0.1082 (1.21)
13	-0.1336 (-2.72)**	-0.4543 (-5.33)***	-0.0657 (-0.49)	-0.7442 (-7.68)***	-0.0508 (-0.52)
14	-0.1801 (-4.34)***	-0.6020 (-8.26)***	-0.1619 (-1.36)	-0.5714 (-7.19)***	-0.0939 (-1.12)
15	-0.1595 (-3.50)***	-0.6029 (-7.53)***	0.0193 (0.15)	-0.7069 (-8.02)***	-0.1137 (-1.25)
16	-0.0970 (-2.07)*	-0.3269 (-4.03)***	-0.2430 (-1.84)	-0.4197 (-4.57)***	-0.1774 (-1.88)
<i>min. Housing status</i>					
Subtenant	0.1887 (5.66)***	0.2341 (4.70)***	-0.0204 (-0.14)	0.3246 (5.14)***	0.2019 (2.70)**
Tenant	-1.1272 (-2.40)*	1.6692 (2.55)*	-0.8895 (-0.52)	-0.6272 (-0.99)	-
Care Home Occupant	0.2594 (2.17)*	2.6672 (19.68)***	-	2.4608 (8.48)***	-
Rent-income-ratio	-2.7158 (-41.40)***	-5.3004 (-45.15)***	-2.5390 (-14.39)***	-6.0487 (-37.49)***	-5.4220 (-30.60)***
Non-Native x log(income)	0.1106 (0.16)	0.5893 (0.41)	2.7399 (0.93)	-5.9883 (-1.81)	1.8781 (0.87)
Mixed x log(income)	0.2375 (0.24)	-	4.2644 (1.38)	-1.0472 (-0.67)	4.7834 (1.99)*
Non-Native x $[0.5 \times (\log(\text{income}))^2]$	0.0072 (0.10)	0.0525 (-0.34)	-0.2620 (-0.87)	0.5570 (1.70)	-0.1740 (-0.83)
Mixed x $[0.5 \times (\log(\text{income}))^2]$	-0.0693 (-0.72)	-	-0.4862 (-0.87)	0.0909 (0.59)	-0.4631 (-2.00)*
<i>N</i>	77,647	23,748	8,532	20,697	23,218

Note: Income is the household post-gov income. Other combination includes multi-generation households. The reference group for the minimum housing status are homeowners.

$N=1,452$ households with other household configurations have not been separately analysed, these are accounted for in the full sample.

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Table 3.8: Income elasticities by migration background

Household	mean	median
Native	-0.265	-0.200
Non-Native	-0.147	-0.0864
Mixed	-0.529	-0.417

Notes: The figures represent the household level responsiveness of vulnerability to changes in income.

3.5.2 Determinants of multidimensional vulnerability

This section examines the various determinants that contribute to multidimensional vulnerability among households.

The household life-cycle stage (Ando and Modigliani 1963, Modigliani and Brumberg 1954) can significantly influence faced vulnerability within a household¹². All else being equal, households in different stages of their life-cycle may display varying degrees of vulnerability. On the one hand, households in early stages, such as those headed by younger individuals, might have a greater capacity to recover from economic shocks due to potential sources of support, like parental assistance hence, facilitated access to financial resources. On the other hand, households in later stages, such as those approaching retirement, might be more susceptible to financial shocks due to reduced earning potential and increased dependence on accumulated savings.

Given the increasing prevalence of non-nuclear households, we differentiate between various household compositions in our empirical estimations. However, we do not explicitly incorporate the life cycle of households into our estimations. After careful consideration, households exhibiting a rent-to-income ratio exceeding 1 have been excluded from the analysis due to the implausibility of such a scenario. Consequently, the remaining sample consists of $N=77,647$ observations. The analysis covers various household types, including single households, single-parent households with up to three children, couples living without children, and those with 1-3 children residing in the household.

Table 3.7 presents the determinants of vulnerability which is represented by the shortfall of the overall household potential. Positive coefficients suggest a greater shortfall from the overall household potential, when a rise in the respective variable occurs. This yields greater vulnerability (a larger shortfall from the potential), opposed to that a negative estimate indicates that the variable is beneficial for reaching a higher household potential. The inclusion of interaction terms between migration background and income aims to examine whether the association between income

¹² Thanks for this valuable comment by the examiners.

and the outcome variable (household potential) differs based on individuals' migration background. This helps to explore potential heterogeneity in the effect of income based on the migration status of individuals.

Further, to accommodate the non-linearity and varying marginal effects of income on vulnerability, alongside including the $\log(\text{income})$ the analysis incorporates $0.5 \times (\log(\text{income}))^2$, leading to a more nuanced and accurate analysis. This inclusion necessitates a distinct analysis on income elasticities as the effect of income on vulnerability varies contingent on the income level. By addressing these non-linearities, the model more accurately captures the complex relationship between income and vulnerability. We begin by presenting the empirical results of the stochastic frontier analysis, followed by a detailed discussion of the income elasticity estimation outcomes. The results of the stochastic frontier analysis presented in Table 3.7 are quite revealing in several aspects. First, considering the full sample (1st column estimates), the estimates for the federal states indicate heterogeneity in vulnerability across states, with Berlin serving as the reference group.

The significant negative coefficient (-2.7158, $p < .001$) in the rent-to-income ratio highlights its crucial role in determining vulnerability, suggesting that vulnerability decreases as the ratio increases. This phenomenon is often observed when a larger share of household income is dedicated to rent payments. In specific regions, a higher rent-to-income ratio may indicate better job opportunities, transportation infrastructure, and access to vital services, ultimately fostering economic resilience and mitigating vulnerability to unemployment or financial instability.

Closer inspection of the minimum housing status (e.g., subtenant, tenant, home occupant) reveals significant differences between subtenants (0.1887, $p < .001$) and homeowners (reference group). The positive and significant coefficient implies that those households residing as a subtenants renders a household significantly vulnerable in contrast to other housing arrangements controlled for: tenants and care home occupants. There are several reasons why subtenants are more vulnerable, including limited legal protections, uncertain tenure, and the potential for rent increases imposed by the primary tenant, ultimately leaving them with scant resources to negotiate effectively. Germany is characterised by a prominent rental housing market, with more than 50 percent of the population renting (German Federal Statistical Office, 2022) and 1.2 percent living as subtenants. According to Holm et al. (2021) being a subtenant is correlated with a lower income level.

Consistent with Holm et al. (2021), who conducted a comprehensive study on housing conditions and social housing provision in major German cities, findings in 2018 indicate that nearly 49.2 percent of tenant households allocated more than 30 percent of their income towards rent, exceeding the affordability threshold. Additionally, 4.4 million households lived in dwellings that were either overcrowded or too

expensive relative to incomes, accounting for nearly 53 percent of all tenant households. These findings highlight the persistence of significant housing affordability and adequacy challenges in Germany.

Income is found to be a significant determinant of household vulnerability (-2.9320 , $p < .001$), implying that as household disposable income increases overall vulnerability decreases.

To further understand how household level vulnerability responds to changes in income across various household migration types, income elasticities have been calculated. The results of these estimations are presented in Table 3.8. The negative elasticities (-0.265 , -0.147 , -0.529) indicate that vulnerability tends to decrease as income increases, implying that higher income levels are associated with lower vulnerability levels. The magnitude of the elasticity indicates the strength of the relationship, where a higher absolute value suggests a stronger relationship between income and vulnerability.

Mixed households (-0.529) show the highest responsiveness to income changes. A 1% increase in income is associated with a 0.529% decrease in vulnerability among mixed households. Similarly, native households would face a 0.256% decrease in vulnerability and non-native a 0.147% decrease. These estimated elasticities indicate that the vulnerability of non-native households is the least responsive to income changes, whereas mixed households demonstrate the greatest responsiveness. These findings carry significant policy implications, prompting further examination of societal stigma, language barriers, and other factors related to integration policies.

The last four coefficients in the model, which represent interaction terms, are not statistically significant when considered individually. However, when performing a joint significance test, the null hypothesis stating that these coefficients are jointly equal to zero is rejected (chi-square value of 706.76 with a p-value < 0.001). This means that, although each term alone does not show a significant effect, their joint influence is crucial for the model's accuracy and explanatory power. Turning to single-person households, the estimates in column 2, Table 3.7 confirm that income serves as a determining factor in explaining vulnerability (-11.1685 , $p < .001$). Additionally, single households, whether they are subtenants, tenants, or occupants of care homes, are more susceptible to face vulnerability when contrasted with single-person households who are homeowners. This observation resonates with findings from the existing literature (e.g., McLanahan and Booth (1989)). For single-parent households (e.g., dependents are < 18 yrs), income (-4.7750 , $p < .001$) implies to be a salient determinant of household vulnerability. Couples living with or without dependent children are more vulnerable when either residing in a care home or being a subtenant as opposed to homeowners.

3.6 Discussion

On the one hand, the empirical results emphasise the complexity of vulnerability dynamics within households and on the other, these indicate the interplay between household composition, migration backgrounds and vulnerabilities.

The empirical results, aligning with previous findings in the German context (see for example, [Giesecke et al. \(2017\)](#), [Janßen and Bohr \(2018\)](#)), suggest that non-native households are more likely to experience multidimensional vulnerability compared to native and mixed households. Further, the results indicate that non-native households are less responsive to increases in income in terms of experienced vulnerability. Specifically, as income increases, the vulnerability of non-native households decreases by a smaller proportion compared to other household types. This implies that additional income reduces vulnerability to a lower extent for non-native households, highlighting a disparity in the economic resilience of different household types. According to the Federal Statistical Office ([2021](#)), the risk of falling into poverty rate in 2021 was 16.9 percent for all households, with 12.5 percent of households without a migration background affected, and 28.6 percent of households with a migration background exposed to a risk of poverty. This raises important policy implications. To reduce the uneven vulnerability distribution faced by non-native households policy-makers should consider implementing measures that address the specific challenges witnessed by this demographic group. This involves developing policies that extend beyond addressing vulnerabilities solely related to income and consumption, but include multifaceted aspects like employment, health, and housing. Tailored support programmes should be implemented to cater to specific needs to effectively mitigate the extent of vulnerabilities. This approach ensures equitable access to resources and opportunities ([Sen 1993](#), [Lovell et al. 1994](#)), fostering a more inclusive and resilient society. [Cattaneo et al. \(2009\)](#) underscores the significant impact of living conditions on overall well-being, while [Zumbro \(2014\)](#) and [Foye et al. \(2018\)](#) identify a positive correlation between home-ownership and life satisfaction. Considering these findings, our analysis takes into account a household's housing status (homeowner, tenant, subtenant), revealing that being a subtenant significantly aggravates a household's vulnerability exposure. As highlighted by [Holm et al. \(2021\)](#), being a subtenant is associated with lower income levels, further emphasizing the complex interconnection between socio-economic characteristics and individual achievements/outcomes. Furthermore, findings from research conducted by [Dewilde and De Decker \(2016\)](#) indicates that individuals with lower income levels often encounter more challenges related to housing affordability. Additionally, in the United States, [Desmond and Wilmers \(2019\)](#) observed that landlords in economically disadvantaged areas exploit this circumstance to increase their profits, mitigating risks at the expense of imposing

high rental burdens on tenants in low-income areas. Our analysis, Figure 3.2, showing the distribution of household achievements and the empirical results presented in Section 4.5, suggests major differences in housing accessibility and affordability across household types. Native households appear to be in a more advantageous position compared to non-native and mixed households. The unequal access to the rental housing market, disparate housing provision, and pronounced spatial segregation based on ethnic background have been extensively documented in Germany (e.g. [Horr et al. \(2018\)](#), [Auspurg et al. \(2017\)](#)). [Clark et al. \(2001\)](#) for example, shows that particularly the housing situation of guest worker households significantly improved in West Germany since 1985, however the gap in living conditions between foreign and German households has hardly reduced, with foreigners experiencing housing market discrimination solely based on their migrant status. This calls for further investigations of regional disparities in living conditions, that go beyond the scope of this study. Addressing housing vulnerability, requires targeted interventions and comprehensive strategies tailored to the unique challenges faced by the most vulnerable population. Prior research, including studies by [Goebel et al. \(2015\)](#), [Lenze \(2021\)](#) and [Andresen et al. \(2022\)](#), has underscored the importance of taking into account specific demographic groups when formulating targeted policies, such as single headed households under the age of 35 (Figure 5.3), single parents living with multiple children (Figure 5.4), families with ≥ 3 children (Figure 5.5)) as shown in Appendix B. To enhance the housing well-being of particularly vulnerable groups, policy makers can consider several measures such as, implementing and strengthening tenant protection policies to safeguard the rights and security of subtenants. This could include laws against unfair evictions and additionally, implementing rent control measures can theoretically help regulate rental prices and prevent excessive rent hikes, making housing more affordable for vulnerable households. Both the German (e.g., [Deschermeier et al. \(2016\)](#), [Thomschke \(2016\)](#)) and international literature (e.g., [Glaeser and Luttmer \(2003\)](#), [Sims \(2007\)](#)) has extensively examined the effect of rent controls, however empirical evidence in Germany suggests that these are ineffective ([Kholodilin et al. 2016](#)) with rents according to [Thomschke \(2016\)](#) still rising under the German rent control ('Mietpreisbremse'). A key strategy is to identify and prioritize vulnerable tenant groups, providing targeted support and resources to assist them in securing stable housing and meeting their basic needs. Efforts aimed at addressing housing vulnerabilities may include initiatives such as providing subsidies to low-income households and creating incentives for the development of affordable housing units. However, as highlighted by [Schier and Voigtländer \(2016\)](#), despite the German federal government's intention to significantly increase funds for promoting social housing to alleviate housing market challenges, this expansion of funding appears to overlook the fundamental issues within the housing market. The primary challenge

identified is the scarcity of available land for construction. Furthermore, the analysis based on SOEP data reveals that the social targeting associated with these efforts is notably limited. Specifically, [Schier and Voigtländer \(2016\)](#) contends that 46 percent of households living in social housing earn incomes below 60 percent of the median income, suggesting a shortfall in addressing the needs of the intended low-income target group. Alleviating the vulnerability faced by households calls for a multi-faceted and more inclusive approach that addresses systemic challenges and ensures equal opportunities for all households, regardless of their migration status, citizenship, location or household structure. This includes the implementation of inclusive policies, fostering integration, promoting education and skill development, providing targeted support programmes, and combating discriminatory barriers/practice.

Further, our results are based on the collective household model ([Cherchye et al. 2007](#)), which assumes that decisions and resources are collectively shared or allocated among household members ([Cherchye et al. 2011](#)). However, this theoretical approach fails to fully account for individuals' bargaining power ([Manser and Brown 1980](#), [Browning et al. 2013](#)) and intra-household dynamics. While a household as a collective unit may not be vulnerable in the context of the model, power imbalances, such as the unequal distribution of decision-making power and the allocation of resources, some household members might still experience vulnerabilities. Recognizing and addressing the dynamics and power imbalances within households (e.g., [Friedberg and Webb \(2006\)](#)) is pivotal in formulating precise policies and interventions that cater to the unique requirements and vulnerabilities of individuals within these households.

3.7 Conclusion

This chapter introduces a novel method measuring both households' achievements and vulnerabilities using sound theoretical background. This method can accommodate multiple resources and multidimensional achievements of a household. The approach to aggregating household's achievements and measuring vulnerabilities is universal and can be readily applied to other data sets that survey households such as 'Understanding Society' in the UK. Based on the empirical application of the proposed methods to German panel household data from 1985-2019, this study yields valuable insights. Firstly, employing PCA, we generate three indices (health, housing, employment) and propose a straightforward aggregation method from individual to household-level data. Comparing native, migrant and mixed households, we find disproportional effects for migrant households with regards to housing achievements. In terms of multidimensional achievement, including health, employment and hous-

ing, native households seem to outperform both mixed and non-native households. Second, the estimations unveil a significant observation: German households, on average, attain approximately 92 percent of their potential given the available resources on the household level. Third, the household composition (native, non-native, or mixed) emerges as a salient factor influencing the level of witnessed vulnerability. When examining the effect of household income in relation to the defined household types on vulnerability, it becomes evident that mixed households are less susceptible to vulnerability compared to native households. Conversely, non-native households emerge as the most vulnerable group when considering income, with native households falling in between the two. These results, based on the household composition, hold true for all different household living arrangements (single households, single-parent households, and couples living with or without children), with highly significant estimates in the full sample covering all household living arrangements. Lastly, we identify heterogeneity over federal states. These findings raise intriguing questions about the underlying causes of the observed disparities and potential strategies to address these.

Chapter 4

Migration and Labour market Performance: A Task-based Approach

4.1 Introduction

International migration and growing population diversity have raised intriguing questions about economic and social integration of migrants into host societies. A crucial aspect of these integration processes revolves around the occupational paths of migrants, particularly in comparison to the native population. Empirical evidence on occupational trajectories between migrants and the native population is pivotal for economic, social and policy implications on migration and integration.

Building upon the task-based framework introduced by [Autor et al. \(2003\)](#) and the documented shift in workplace skill requirements, as outlined by [Levy and Murnane \(1992\)](#) and [Levy and Murnane \(1996\)](#), this study applies the representative longitudinal SOEP panel data spanning from 1984-2020 to investigate the regional occupational dynamics within job task categories among native-born individuals and migrant groups¹. This study examines the convergence or divergence of occupational trajectories within job task categories among native-born, foreign-born, and second-generation migrant populations in Germany, focusing on regional variations at the federal state level.

While previous studies on Germany have examined the task-specific substitutability between migrants and native-born individuals ([Haas et al. 2013](#)), to the best of our knowledge, this study is the first attempt to explore task-based convergence between native-born, foreign-born and second-generation migrants in Germany, with a specific focus on the regional, federal state level. We employ a random coefficients model, assuming that the parameters of our model/distribution of the migrant population within job tasks vary across federal states, providing valuable insights on regional

¹ foreign-born and second-generation migrants

variations and nuances. In the initial empirical analysis at the aggregate level, we use convergence regression models to investigate job task disparities between migrants and the native population. These findings consistently show migrants closing the gap with native workers across all specified job categories. Subsequently, we shift the focus to the regional dynamics within Germany, specifically at the federal state level. To enhance the robustness of our findings and the conclusions drawn at the aggregate level, we implement a random coefficients model. This model considers the influence of the proportion of specific migrant groups on existing occupational disparities with the native population.

The findings unveil intriguing patterns of occupational convergence and divergence between native and migrant populations in different job tasks and regions, with some areas showing a narrowing gap, while others exhibit significant disparities. On the aggregate level, we observe convergence across all job task categories among all populations. However, the regional dynamics present a more differentiated picture. East German states tend to have a higher occurrence of occupational divergence between native and migrant populations, while West German states generally exhibit more instances of convergence across various job tasks. Several West German states, including NRW, Hessen, Baden-Wuerttemberg and Hamburg show statistically significant convergence in *non-routine analytic* tasks over time between native and migrant workers (both foreign-born and second generation migrants). Additionally, Hamburg, NRW, Hessen, Bayern, Berlin, and Saarland (West German states) exhibit the highest number of statistically significant instances of task-based convergence between native and migrant populations.

The unique focus on task-based convergence between native-born and migrant populations at the regional level in Germany distinguishes it from previous research. It not only expands the academic discourse but also offers valuable insights into the regional variations in integration dynamics. The empirical evidence offers significant implications for policy-making and economic analysis at the federal state level, emphasising the importance of skill development, occupational integration, targeted interventions, collaboration, adaptability and social cohesion in addressing the dynamic shifts in the German labour market.

The remainder of the article is organised as follows: Section 4.2 reviews related literature, Section 4.3 describes the data and the methods are introduced in Section 4.4. Section 4.5 presents the empirical results. Section 4.6 and Section 4.7 discuss and conclude the results within the broader migration and integration debate.

4.2 Literature Review

This section, firstly provides an overview of the task-based approach and secondly, examines the existing literature on migrants' socio-economic standing and labour market outcomes in Germany.

4.2.1 The task-based approach

Contemporary research adheres to the concept of aligning activities performed by workers with the skill requirements to successfully execute these job tasks (Autor et al. 2003, Spitz-Oener 2006, Acemoglu and Autor 2011). This paper draws upon the theoretical framework proposed by Autor et al. (2003), providing a conceptual explanation of the impact of computers on the labour market, addressing how they complement skilled labour and substitute for unskilled labour, ultimately influencing workplace skill demands. Autor's model informed by the inherent capabilities of computers, specifically their proficiency in executing procedural or rules-based logic, builds upon an extensive literature on the demand for skills, including the work by Juhn et al. (1993), Juhn (1999), Katz and Murphy (1992), Murphy and Welch (1993) and Welch (2000). Autor et al. (2003) distinguish between routine and non-routine tasks. While non-routine tasks require problem-solving, specialised knowledge and are characterised by their non-repetitive nature, thus more resistant to computerisation, routine tasks typically follow predictable patterns and consequently are more susceptible to automation. Further, non-routine tasks are classified as *analytic*, *manual* and *interactive*. For simplicity and greater comparability among the various migration backgrounds in Germany, the underlying study distinguishes between four task-categories: routine manual, routine cognitive, non-routine analytic and non-routine manual. Within the framework it is assumed that computers fulfil two roles, firstly, these substitute for routine (repetitive) cognitive and manual tasks, and secondly, complement non-routine problem-solving and interactive tasks. The underlying theoretical premise of the model is rooted in the notion that routine and non-routine tasks are characterised as imperfect substitutes, hence resulting in measurable changes in the composition of job tasks and skill demands. Employing observational data from the Dictionary of Occupational Titles to directly assess how technological advancements have impacted the cognitive and manual aspects of job tasks between 1960 and 1998, the study further examines changes within industries, education groups, and occupations. Finally, Autor et al. (2003) look at the extent to which alterations in job task composition driven by computerisation might have played a role in the recent increase in the demand for educated/skilled labour.

Within the domain of labour market analysis, the task-based approach serves as

a valuable and insightful lens for exploring the complex relationships among technology, skills, and workforce dynamics within the labour market. A multitude of studies has embraced the framework proposed by [Autor et al. \(2003\)](#) in labour market research. The study by [Gathmann and Schönberg \(2010\)](#) for example, investigates the transferability of labour market skills by introducing the concept of task-specific human capital. The findings suggest that skills acquired in the labour market are more adaptable than previously assumed. Individuals tend to transition to occupations with similar task requirements, and task-specific human capital plays a substantial role in driving individual wage growth. For Germany the seminal work presented by [Spitz-Oener \(2006\)](#) emphasises the strong link between technological advancements and the need/demand for advanced skills in the workplace. The following presents a thorough review of pertinent studies relevant in the context of this research.

[Haas et al. \(2013\)](#) investigate the performance of migrants in the German labour market relating the former to the types of tasks they perform in their jobs. The authors estimate substitution elasticities within aggregate production functions using administrative data and they draw upon the task-based approach. The findings reveal notable variations in the substitutability between migrant and native workers across different levels of qualification and job tasks. To begin, workers with low formal qualifications, both migrants and natives, exhibit a higher degree of substitutability in the labour market compared to those with medium or high formal qualifications. Among individuals with medium qualifications, migrants and natives are more interchangeable in manual tasks, but less so in interactive tasks. Finally and noteworthy, in the context of interactive tasks, the results unveil that highly qualified migrants and highly qualified natives can be considered good substitutes. The study identifies specific challenges to labour market integration, for interactive intensive tasks.

Both [Sebastian and Ulceluse \(2019\)](#) and [Amuedo-Dorantes and De La Rica \(2011\)](#) draw their research upon [Peri and Sparber \(2009\)](#), whereby immigrants are expected to possess a comparative advantage in manual over interactive tasks due to their restricted language proficiency and limited host country-specific human capital. [Sebastian and Ulceluse \(2019\)](#) explore how native labourers take a task specialisation decision in response to the rise in relative labour supply due to immigration to Germany. Accounting for comparative advantages due to language skills, the study in particular investigates whether natives shift their choice towards communication-intensive occupations. The authors show that when facing an increase in migration, German workers adjust their tasks allocation by choosing communication intensive over manual tasks. Notably, it is observed that the reduction in the supply of communication-intensive tasks is more pronounced and resilient compared to the rise in manual task supply, suggesting that more rigid labour markets show lower adaptability when facing immigration induced disruptions. In the same vein, studying the effects of

an increase in the proportion of foreign-born labourers on the tasks specialisation of native workers in Spain, [Amuedo-Dorantes and De La Rica \(2011\)](#) reveal that as there is an increase in immigrants, native workers, particularly woman shift away from manual to more communication intensive roles. This could be attributed to the concentration of immigrants in female-dominated occupations and differences in job tenure and education.

4.2.2 Migrants' labour market performance

Migration has been studied across various adjacent disciplines, each contingent upon the unique context and institutional framework of the host country. While there is a large body of scholarly work addressing the economic outcomes and determinants of migrants, it is well recognised that these outcomes are closely tied to the specific socioeconomic conditions of the recipient country. Previous studies addressing immigrants' labour market outcomes in Germany have diligently considered various socioeconomic factors, such as income and educational disparities between native and immigrant populations, as for example, evidenced by [Brücker et al. \(2021\)](#) and [Kogan \(2011\)](#). However, there remains a significant research gap concerning occupational disparities between native and migrant populations, particularly in the context of specific job tasks. This research gap is particularly pronounced when examining variations at the federal state level, which is essential given the significant regional disparities within Germany. Economic conditions, labour markets and related opportunities vary widely by the federal state in Germany. While some federal states flourish with solid economies characterised by ample employment opportunities, others struggle with economic challenges, hence understanding how migrants fare in different economic contexts is important to comprehend regional variation. Additionally, addressing job task related convergence and divergence between the native and migrant population is vital for shaping effective integration policies and enhanced resource allocation while promoting both economic efficiency and social cohesion.

Examining prior research on migrants' labour market performance in Germany, several key themes emerge. In the following these studies will be classified into three dimensions: occupational segmentation, income disparities, and educational attainment- offering insights into the challenges and opportunities migrants encounter in their pursuit of economic integration.

[Sprengholz et al. \(2021\)](#) explores the long-term labour market performance of different arrival cohorts of foreign-born individuals who immigrated to (West) Germany. The study finds that the employment status of both female and male migrants improved across various entrant cohorts, revealing increased educational levels. Consid-

ering the duration of stay, the analysis reveals that the occupational status of different migrant cohorts typically declined in the initial years after their arrival, followed by a subsequent period of stability, possibly due to out-migration. The findings imply discernible disparities in the labour market outcomes of migrants, with a specific focus on migrant women. Earlier cohorts of migrant women worked longer hours than native women, but this changed over time with subsequent female migrant cohorts working fewer hours. [Kring \(2021\)](#) examines the surge in low-wage employment among migrants in Germany since the late 1980s. The study attributes this rise to a combination of human capital factors, institutional changes, and shifts in organisational structures. It is argued that these changes have disproportionately affected migrants and consequently contributed to a substantial increase in low-wage jobs.

As exemplified by [Pischke \(1992\)](#), [Schmidt \(1997\)](#), and [Aldashev et al. \(2012\)](#), a considerable body of literature consistently highlights a critical pattern in migrants' earnings prospects in Germany. Recent migrants tend to earn considerably less than their German counterparts during their initial years in the country, but as time progresses, wages tend to converge, aligning with findings in studies such as [Romiti et al. \(2015\)](#) and [Lehmer and Ludsteck \(2015\)](#). [Bossler \(2014\)](#) confirms that recent migrants in Germany are more likely to occupy lower-paid positions compared to long-term residents. Numerous factors contribute to these wage disparities, including sorting mechanisms that allocate migrants to specific workplaces and job roles ([Granato and Kalter 2001](#)), underrepresentation in well-remunerated positions, limited career development prospects, and occurrences of biased (discriminatory) practices. Immigrants often accept lower reservation wages ([Nanos and Schluter 2014](#)). Over time, observable characteristics such as education, work experience, and regional location ([Brunow and Jost 2020](#)) collectively contribute to wage disparities. From 2010 onwards, skilled immigration from third countries has helped alleviate the scarcity of professionals across various economic sectors. [Zibrowius \(2012\)](#) examines wage profiles and finds that immigrants in Germany, except for those in the low and partially medium-skill group, face challenges in achieving wage parity with native Germans, even after accounting for work experience and years since migration. Highly skilled immigrants, in particular, face significant earnings disadvantages, raising concerns about potential discrimination in job opportunities. [Brunow and Jost \(2022\)](#) find that vocational qualifications and naturalisation status impact wage disparities among migrants in Germany, but these disparities diminish as migrants gain vocational training and work experience. Regarding the second generation of migrants, [Stockhausen \(2022\)](#) found that migration background has a marginal influence on incomes in Germany. [Plünnecke \(2023\)](#) reveals that, German natives earn higher median wages than foreign nationals, however individuals from India, Northern Europe, and Austria earn notably more than the median wage of German nationals. Additionally, the

study underscores substantial disparities in employment growth within academic STEM fields, with foreign nationals experiencing remarkable growth compared to native Germans. In summary, wage disparities between migrants and Germans substantially diminish over time as migrants accumulate work experience and attain additional education and training.

On the educational dimension of labour market effects, multiple strands of empirical evidence provided by [Peri and Sparber \(2009\)](#), [Dustmann et al. \(2005\)](#) and [Kahanec and Zimmermann \(2009a\)](#) highlight the profound influence of the skill distribution and qualifications inherent to the migrant population on their labour market outcomes. These dimensions are closely tied to the successful integration of migrants into the labour market. Further, a substantial body of literature explored the relationship between immigration and labour market disparities, shedding light on multifaceted aspects such as employment opportunities, job security, wages and hours worked (e.g., [Adsera and Chiswick 2007](#), [Kahanec and Zimmermann 2008](#), [Dustmann and Frattini 2011](#), [Dustmann et al. 2013](#)). Previous research offers a varied perspective on the educational integration of immigrants compared to the native population. [Riphahn \(2003\)](#), [Fick \(2011\)](#) and [Gries et al. \(2022\)](#) have examined educational achievements and economic outcomes of migrants in Germany, with a particular emphasis on aspects of social mobility and assimilation spanning across different generations. More specifically, [Riphahn \(2003\)](#) examined the educational achievements of German-born migrant children and found that their educational performance lags behind that of native Germans, indicating persistent educational disparities. This viewpoint is supported by [Kristen and Granato \(2007\)](#), who highlight the significant disadvantages faced by primarily Turkish and Italian second-generation descendants in comparison to natives. In contrast to the educational progress of foreign-born migrants, second-generation migrants, and natives, [Algan et al. \(2010\)](#) identified substantial differences between former guest workers and native Germans, contributing to the overall educational gap between foreign-born individuals and natives. While [Algan et al. \(2010\)](#) argue for a diminishing educational gap between second-generation migrants and Germans, a persistent gap for Turkish, Yugoslavian, and Italian descendants is observed. These findings are further affirmed by [Gries et al. \(2022\)](#), who suggest that immigrants with ethnic backgrounds sharing a cultural affinity with German traditions and language tend to exhibit enhanced educational achievements.

Overall, the studies by [Brücker et al. \(2021\)](#) and [Basilio et al. \(2017\)](#) reinforce the importance of educational recognition, of qualifications acquired abroad, in achieving positive labour market outcomes. [Brücker et al. \(2021\)](#) highlights the enduring return of educational recognition, resulting in 20 per cent higher incomes compared to those who do not endeavour the recognition in addition to a 25 per cent point increase in incomes in the long-run.

4.3 Data

The following section outlines the data sources, selection criteria and key elements of the data set used in this study to provide a comprehensive understanding into the subsequent empirical analysis, findings and discussion.

4.3.1 Socio-economic panel and job task classification

The data are compiled from the [SOEP](#) (Version 37), which provides both household and individual level data on personal characteristics, education, living arrangements, income, employment occupational and migratory history up to the year 2021².

The SOEP panel data set allows the distinction between a set of migration backgrounds. Hence those without any personal or family migratory history are classified as 'native', those born in Germany with at least one parent born abroad, 'second generation migrant', and those with personal migration history 'foreign'. In accordance with this distinction and to get a better understanding to which extent job task outcomes of individuals with a variety of backgrounds are affected by news induced sentiment, we filter survey respondents who have a least some sort of migratory background.

The ISCO (International Standard Classification of Occupations) system is widely used to classify jobs and occupations. There are two different classification system ISCO-08 and ISCO-88 provided within the SOEP dataset. For the occupational classification we choose ISCO-08 introduced 2008, as it offers enhanced coverage and accuracy of occupational classification offering more granularity in capturing contemporary occupational realities³. This paper draws on the job task classification à la [Autor et al. \(2003\)](#) assigning over 400 available job tasks within the SOEP-Core data set to the following four categories: routine cognitive, routine manual, non-routine analytic and non-routine manual. To cover and classify job tasks spanning from 1984-2017 this study utilises the variables `Isco88`, and `ISCO08` for 2018-2020 respectively. `Isco88` has 444 and `ISCO08` 459 job tasks, which have been rigorously assigned to one of the proposed job tasks categories in line with [Autor et al. \(2003\)](#). To conduct the occupational classification, where the goal is to categorise more than 400 occupational descriptions into 4 distinct job task categories, according to contemporary practice models such as Naive Bayes, known for its efficiency, interpretability

² The German Socio-Economic Panel (SOEP) is a longitudinal panel data set and one of the largest and longest-running multidisciplinary household surveys conducted since 1985. Yearly, approximately 30,000 individuals in 15,000 households are interviewed.

³ ISCO-08 provides more detailed categories inclusive of new occupations that emerged in various sectors, such as IT and services.

and simplicity and Support Vector Machines (SVM) emerge as the most appropriate choices to carry out the underlying job task classification (a comprehensive overview is provided by [Kowsari et al. \(2019\)](#) and [Minaee et al. \(2021\)](#)). These models are well-suited when dealing with a small number of categories and a moderate-sized data set, streamlining the classification process. We use Naive Bayes, to conduct the job task classification.

4.3.2 Control Variables

The primary focus is to understand how the proportion of foreign-born individuals carrying out specific job tasks contributes to the convergence or divergence among subpopulations (native, foreign-born, second generation migrants) on the federal state level. To control for macroeconomic determinants affecting the potential convergence or divergence of job tasks and thus showcasing socio-economic achievements between natives and migrants in Germany, several indicators available on the aggregate country level such as labour productivity, number of job vacancies, labour force, and household savings could have been included, however, only few macro indicators are available on the federal state level in Germany for the specified period. Since this study seeks to explore the regional effects of tasks based adaptation (convergence/divergence), a limited number of control variables is available on the federal state level, included control variables available on the state level are the following: unemployment rate and GDP growth.

4.4 Methods

This study is focused on exploring the task-based convergence/divergence among distinct populations (native, foreign-born, second generation migrants) across federal states in Germany. The inherent heterogeneity in both spatial distribution and demographic composition calls for a modeling approach that can effectively accommodate and capture the non-uniform nature of these relationships.

Therefore, in the context of this research and given the variability in the data, the use of a linear random coefficients regression model as introduced by [Swamy \(1970\)](#) is well-justified. Allowing coefficients to vary across regions and populations, this model provides a robust framework to analyse the extent of occupational divergence/convergence among the subpopulations more comprehensively and accurately. In a random coefficients model it is assumed that both the intercept and slopes vary across groups.

Suppose there are 16 federal states and the dependent variable Y is estimated as differences in proportions between subgroups across four tasks within these federal

states, capturing the convergence or divergence dynamics between subpopulations. The interest, now turns to understanding how the proportion of migrants engaging in specific job tasks, the unemployment rate, and GDP growth rates on the federal state level, further denoted as X (state level controls) affect the observed differences Y . Individual-level data pertaining to occupational tasks has been aggregated to proportions at the federal state level by the distinct subpopulations (native, foreign-born, second generation migrants). This can be formally expressed as:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + \epsilon_{ij}$$

Where i represents the individual level and j the federal state level. β_{0j} denotes the intercept, β_{1j} the slope and X_{ij} the corresponding federal state level controls: the share of migrants within specific tasks, unemployment rate, and GDP growth rates respectively. β_{0j} and β_{1j} vary across federal states. ϵ_{ij} is the error term capturing the individual-level error term representing the unexplained variance at the individual level within each federal state. The equation above assumes that every individual i in federal state j has one residual. However, it overlooks the interdependence of residuals within a federal state, that are potentially correlated. Furthermore, it neglects the fact that federal states may vary in size or similar characteristics, preventing us from determining whether the effect is more pronounced in one federal state compared to another. Therefore u_{0j} , a random intercept (random effect) is introduced. This implies that the intercept β_0 is not fixed across all federal states, but is treated as a random variable for every federal state, allowing the data to vary along the y-axis. Hence, it can be stated that β_{0j} the intercept varying across federal states, is equivalent to $\beta_{0j} = \beta_0 + u_{0j}$ or when combining both equations, the relationship becomes:

$$Y_{ij} = \beta_0 + \beta_{1j}X_{ij} + u_{0j} + \epsilon_{ij}$$

The error term is decomposed in two components, $u_{0j} \sim N(0, \gamma_{00}^2)$ following a normal distribution with a mean of zero and a common variance γ^2 , and $\epsilon_{ij} \sim N(0, \delta^2)$. As we aim to estimate a random effect rather than specific (fixed) characteristics, it is crucial to estimate the variances, capturing the distribution of these random variables. Collectively these two error components account for variability and unexplained variance in the regression model.

In the spirit of [Greene \(2012\)](#), who was inspired by the seminal work on firm investment behaviour by [Grunfeld and Griliches \(1960\)](#), we test for the assumption of parameter constancy using the chi-square (likelihood ratio) test. The chi-square test provides a mechanism to determine whether the observed differences in coefficients are statistically significant or simply a result of random variation. By comparing the observed deviations from constancy to what would be expected under the assump-

tion of constant coefficients, the chi-square test enables to draw conclusions about the presence or absence of heterogeneity. The likelihood ratio test for assessing parameter constancy examines the null hypothesis H_0 , which posits that the variances of random coefficients are zero, suggesting constancy, as opposed to the alternative hypothesis, suggesting that the variance of random coefficients is > 0 .

4.5 Results

This section provides descriptive statistics on employment rates, job task dynamics and evidence regarding the convergence between natives and migrants in Germany, utilising a task-based approach. First, the analysis adopts a convergence regression method similar to the concept of economic growth convergence. This method is applied at the aggregate country level (Germany), where a negative relationship would indicate that migrants are narrowing the gap with their native counterparts. Secondly, the section proceeds to presenting the results at the German federal state level, where a random coefficients model is employed.

Figure 4.1 represents the employment rate dynamics between foreign-born and native-born individuals over the period spanning 1984 to 2020. The employment rate ratio, calculated as the employment rate of foreign-born individuals relative to that of native-born individuals, serves to provide valuable insights into the the labour market dynamics for these two groups within the working-age population in Germany. The data reveals a volatile employment rate ratio over the years, ranging from approximately 0.36 to 1.47. Values below 1, indicate a lower average employment rate for foreign-born individuals compared to the native population, as opposed to values above 1, suggesting a higher average employment rate for foreign-born individuals. There is a notable shift in the employment rate ratio around 1987, approaching 1, and subsequently surpassing 1 in 1990, with values reaching 1.47 and 1.44, respectively, indicating a significant change in the employment dynamics between foreign-born and the native population in Germany. Several factors may explain this trend. Firstly, during the 1980s and early 1990s, migrants played a vital role in the German labour market, contributing to various industries that were integral to Germany's economic development following WWII. The manufacturing sector witnessed a considerable growth of migrant workers, particularly within the automotive and engineering industries. Secondly, the construction industry, driven by economic growth and urban development, generated a demand for foreign labour, with migrants playing a crucial role in meeting these needs. In sum, this highlights the dynamic and substantial impact by migrant labourers in shaping the economic landscape during these transformative years. The low employment rate ratios in 2012 and following 2015 reflect

the enduring consequences of the 2008 financial crisis and the subsequent refugee crises in Germany. Figure 4.2, highlighting the employment rate dynamics between the different sub-populations confirms the observations derived from Figure 4.1 described above. A more disaggregated breakdown of regional employment dynamics, distinguishing between East and West Germany, is illustrated in Figure 4.3. The Figure indicates a prevalent trend of higher employment rates across all subgroups in West Germany, which can be ascribed to historical economic disparities between East and West Germany.

The observations derived from Figure 4.4 reveal several compelling trends in job task trajectories, characterised by a pronounced increase in non-routine analytic tasks and a corresponding decrease in routine manual tasks. This finding aligns with the contemporary discussions (e.g., [Acemoglu and Loebbing \(2022\)](#)) on the effect of digitisation and technological advancements with a rising demand of non-routine cognitive skills. The regional differentiation (East/West), as depicted in Figure 4.5, reveals notable distinctions in occupational patterns. Since the 2000s, the percentage of the West German population engaged in non-routine analytic tasks is slightly higher than that of the East. Concerning routine manual tasks, a higher proportion of the population in East Germany is engaged in this category compared to the West. Routine cognitive tasks exhibit a higher prevalence in the West than in the East. Lastly, East Germany has a marginally higher share of the population employed in routine manual labour. Overall, the examination of regional job task patterns implies that divergent trends within non-routine analytic and routine cognitive tasks between the two regions stem from a combination of regional and historical factors. Nevertheless, these factors are not further discussed in more detail, as these extend beyond the scope of the current study.

Table 4.1: Regression table

State	Group specific coefficients	Non-routine manual		Non-routine analytic		Routine manual		Routine cognitive	
		N and F	N and 2nd	N and F	N and 2nd	N and F	N and 2nd	N and F	N and 2nd
1	share of migrants	0.3455*	omitted col.	-0.9280***	0.1095	-0.2408*	-0.2077	-0.2671*	0.2009*
	unemployment	(0.14)		(0.05)	(0.11)	(0.13)	(0.12)	(0.13)	(0.10)
	GDP	1203.955**		-114.7221**	260.9234*	366.5129***	331.3194*	25.3965	-8.7075
	cons.	(41.32)		(39.86)	(102.39)	(104.48)	(145.76)	(23.12)	(89.08)
2	share of migrants	-152.381*		-157.9382	-154.7688	549.7996	-24.3187	-351.4675*	-284.6217
	unemployment	(89.08)		(218.91)	(230.86)	(447.82)	(21.29)	(150.37)	(303.94)
	GDP	14.3494		73.295*	-29.5993	-85.3405	-68.756	59.7255*	54.7487
	cons.	(12.50)		(31.64)	(45.6472)	(71.87)	(30.6918)	(22.22)	(55.58)
3	share of migrants	-0.8777**		-0.2137**	0.12	-0.1409	-0.153**	-0.1106	-0.3205*
	unemployment	(0.36)		(0.09)	(0.12)	(0.14)	(0.13)	(0.13)	(0.13)
	GDP	232.67**		-170.5638***	63.847	401.0793***	-67.570	43.9262*	103.7915
	cons.	(34.66)		(43.82)	(101.53)	(104.25)	(132.20)	(17.64)	(92.77)
4	share of migrants	37.2772		506.1977**	163.80	-96.2345	42.9876	-407.5716***	-96.1178
	unemployment	(78.62)		(190.99)	(201.58)	(60.99)	(208.32)	(123.34)	(267.48)
	GDP	-2.9723		-18.86	-1.0264	-14.89	-14.89	81.9609***	21.95
	cons.	(15.14)		(29.32)	(45.6770)	(60.995)	(37.67)	(21.28)	(52.07)
5	share of migrants	0.06476		-0.6830**	0.0444	0.1780*	-0.611***	-0.8092**	-0.1993
	unemployment	(0.20)		(0.15)	(0.09)	(0.11)	(0.06)	(0.12)	(0.14)
	GDP	37.3974**		-25.0540	28.9674	32.3136	-60.6300*	-53.3895***	7.4720
	cons.	(16.54)		(36.35)	(54.165)	(34.42)	(161.37)	(48.03)	(480.37)
6	share of migrants	819.8197***		300.5903	163.8028	1085.834	1383.875**	-274.5292	-40.6805
	unemployment	(236.26)		(423.35)	(201.58)	(771.70)	(414.26)	(216.42)	(579.39)
	GDP	-36.1596***		23.4807	-1.9264	-28.9402	-65.2968***	34.5190***	9.4904
	cons.	(10.53)		(45.78)	(45.68)	(17.00)	(92.00)	(24.11)	(241.1)
7	share of migrants	0.3731**		-0.8936***	0.1109	-0.0580	0.4823**	-0.8572***	0.4419**
	unemployment	(0.15)		(0.09)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
	GDP	117.8633*		5.7890	74.5111	200.0002*	274.331	16.30	211.6670*
	cons.	(61.87)		(91.68)	(421.97)	(174.44)	(22.15)	(88.17)	(88.17)
8	share of migrants	-83.4114		-6521.59*	-13239.85**	-122284.72*	5745.602	-329.12	8091.622*
	unemployment	(62.78)		(2583.44)	(4321.97)	(5034.58)	(1440.97)	(4545.90)	(4545.90)
	GDP	-4.9828		185.1826***	293.2758	280.3631**	-140.64	24.5197	-178.82*
	cons.	(50.64)		(54.61)	(94.91)	(31.38)	(95.48)	(30.14)	(67.38)
9	share of migrants	-0.2500		-0.4715***	-0.0570**	0.7214***	0.6897***	-0.9536***	-0.5345***
	unemployment	(0.18)		(0.08)	(0.10)	(0.06)	(0.03)	(0.08)	(0.08)
	GDP	36.2951**		-58.6251*	-96.0185*	-45.0443	-93.4162***	3.4522	10.0609
	cons.	(27.29)		(27.29)	(42.86)	(31.46)	(18.67)	(18.67)	(20.40)
10	share of migrants	-203.4216		-2033.561*	1823.26	1609.28	252.2588**	1919.44*	1919.44*
	unemployment	(65.71)		(1187.65)	(225.59)	(1260.15)	(971.52)	(809.28)	(1313.15)
	GDP	6.3720		57.7453***	19.4166	-2.6920	-36.1238**	-0.3667	-8.0766
	cons.	(6.28)		(11.69)	(24.60)	(12.43)	(8.63)	(7.7064)	(12.33)
11	share of migrants	-0.8848***		-0.9975***	0.0305	0.1033***	0.7321***	-0.8570***	-0.3101*
	unemployment	(0.22)		(0.19)	(0.11)	(0.14)	(0.13)	(0.11)	(0.14)
	GDP	-39.6707		-208.7041***	-232.6117**	-285.0281**	-190.21*	25.0212	-57.7548
	cons.	(28.86)		(62.02)	(85.16)	(93.42)	(78.37)	(25.49)	(76.14)
12	share of migrants	815.2319		-112.7562	1035.44	1250.10	1046.68	462.50	1119.68
	unemployment	(379.68)		(1162.78)	(1035.44)	(1250.10)	(1046.68)	(462.50)	(1119.68)
	GDP	-21.96*		100.3681*	49.6961	-70.7137*	45.978*	-25.9057	-47.7019
	cons.	(13.22)		(44.78)	(33.47)	(41.58)	(35.47)	(15.86)	(38.02)
13	share of migrants	-0.9762***		-0.9762***	0.0709	-0.2881*	-0.7080***	-0.2150	-0.5101*
	unemployment	(0.15)		(0.10)	(0.14)	(0.07)	(0.14)	(0.14)	(0.13)
	GDP	-20.0367		-9.7947	-52.6752	-57.3961	163.8444	-9.9293	41.5670
	cons.	(27.73)		(45.08)	(118.84)	(59.91)	(101.77)	(23.72)	(87.71)
14	share of migrants	-115.8951*		-115.8951***	0.7611***	0.8111***	0.3142	162.4408	93.9739
	unemployment	(80.73)		(253.1925)	(616.43)	(280.21)	(431.10)	(173.24)	(509.49)
	GDP	30.9079**		143.6742***	-95.3895*	86.8933***	37.2934	2.2247	4.7045
	cons.	(14.51)		(24.23)	(51.95)	(24.15)	(38.04)	(14.83)	(42.28)
15	share of migrants	2.6264		-86.4674**	-36.6871	-27.6724	21.2692*	37.8427	37.8427
	unemployment	(7.02)		(43.50)	(31.23)	(31.57)	(29.20)	(11.05)	24.37
	GDP	990.4468		-894.707***	-9395.109**	-5418.117**	-5334.804**	910.6969	-93.0461
	cons.	(695.54)		(1460.29)	(1529.22)	(1758.48)	(980.48)	(2322.64)	(2322.64)
16	share of migrants	-11.0358		151.4873**	172.2932**	58.6661**	56.1226**	4.9135	6.5591
	unemployment	(8.40)		(21.81)	(21.3293)	(18.15)	(20.69)	(13.58)	(30.35)
	GDP	-0.8026***		-0.4660***	-0.1639	0.4701***	0.3860**	-1.0173***	-0.8500**
	cons.	(0.13)		(0.09)	(0.12)	(0.08)	(0.07)	(0.07)	(0.07)
17	share of migrants	14.8409*		14.8409*	1.4732	-28.6680	4.3829	16.0639	7.9921
	unemployment	(8.61)		(26.64)	(40.50)	(19.35)	(34.52)	(10.25)	(13.63)
	GDP	242.1527*		105.31	203.3862	-213.08	-253.6748	-455.4731**	-525.5897*
	cons.	(138.99)		(432.08)	(542.82)	(431.59)	(159.39)	(211.45)	(211.45)
18	share of migrants	-18.33		24.0046	-8.4980	18.6652	10.9892	57.7174***	62.0593*
	unemployment	(12.68)		(38.92)	(50.36)	(23.25)	(42.88)	(15.84)	(22.44)
	GDP	-1.0191***		-1.3600***	0.0154	1.1658***	-0.2425*	-1.1219***	0.3353*
	cons.	(0.13)		(0.13)	(0.13)	(0.13)	(0.12)	(0.13)	(0.13)
19	share of migrants	-14.8673		-140.1121**	-120.0236	-113.3893	199.3425*	-27.0574	61.3420
	unemployment	(32.54)		(52.12)	(267.71)	(73.26)	(115.43)	(23.93)	(99.33)
	GDP	102.2688		-390.7884*	511.5852*	-102.2497	-27.9396	-6.3127	542.4902*
	cons.	(69.334)		(202.1656)	(267.71)	(120.48)	(171.67)	(79.41)	(256.78)
20	share of migrants	-14.7497		142.6933**	142.6933**	52.8955	114.359	-114.301*	-114.301*
	unemployment	(12.96)		(48.92)	(50.56)	(24.41)	(17.86)	(53.18)	(53.18)
	GDP	-0.4513**		-0.5096	0.2729*	0.5229**	0.2863*	-0.7628***	-0.5289**
	cons.	(0.15)		(0.12)	(0.09)	(0.09)	(0.09)	(0.11)	(0.12)
21	share of migrants	10.6590		10.6284	51.9744*	81.0146	37.7904*	-16.5899	-16.5899
	unemployment	(14.59)		(39.07)	(27.57)	(37.34)	(45.37)	(17.86)	(31.93)
	GDP	423.41		2158.793	1906.45	247.8443	1369.313	361.8011	681.672
	cons.	(484.84)		(1597.31)	(1370.71)	(866.78)	(1296.67)	(721.17)	(1557.68)
22	share of migrants	-13.8384		-84.7438	-98.6830	-33.144	-2.9613	-7.9354	-7.9354
	unemployment	(20.62)		(70.06)	(61.48)	(35.53)	(56.51)	(31.33)	(67.73)
	GDP	0.0211		-0.6336***	0.0978	0.7978**	0.1245*	-0.0092	-5.791***
	cons.	(0.14)		(0.19)	(0.09)	(0.06)	(0.05)	(0.06)	(0.07)
23	share of migrants	64.1156		64.1134	99.5382	794.8189	61.3878***	14.5051	241.98**
	unemployment	(36.70)		(56.50)	(66.72)	(47.02)	(115.04)	(26.16)	(80.32)
	GDP	707.6524		-1634.09	-292.7132	2042.44	-561.67*	5166.905**	-3483.666
	cons.	(649.06)		(1933.40)	(2253.59)	(1633.94)	(2730.81)	(1148.41)	(3620.39)
24	share of migrants	-7.7530		22.270	26.0111	-45.5747*	35.4845	-44.9733**	37.6271
	unemployment	(8.70)		(23.48)	(24.36)	(19.24)	(29.88)	(12.93)	(44.93)
	GDP	0.7591**		0.1742*	0.1456*	0.2159*	0.2508**	.1970*	-0.4007**
	cons.	(0.04)		(0.8)	(0.05)	(0.08)	(0.07)	(0.10)	0.11
25	share of migrants	-31.4978**		287.94***	276.27	332.6265**	224.8562***	82.2141**	41.7956
	unemployment	(74.91)		(48.21)	(79.72)	(120.44)	(62.30)	(28.25)	(41.75)
	GDP	-388.2338		-5571.671*	-1097.80	-6107.571***	-64.7524	-2351.415**	-4311.848*
	cons.	(530.96)		(2375.40)	(2485.81)	(1532.18)	(1525.19)	(873.40)	(1906.94)
26	share of migrants	24.2556		197.5311*	39.2150	203.7593**	2.4838	90.3727**	170.041*
	unemployment	(19.84)		(80.82)	(92.90)	(128.90)	57.68	31.48	72.034
	GDP	0.8044**		0.2717*	0.1729	-0.2894**	0.0044	0.1493	0.1918*
	cons.	(0.050)		(0.14)	(0.13)	(0.11)	0.15	0.11	0.09
27	share of migrants	66.7637***		143.5563*	186.0067*	67.1788	194.5322*	66.2548**	55.9354
	unemployment	(25.75)		(84.54)	(79.72)	(49.63)	(95.30)	24.87	46.01
	GDP	-393.93		-648.7615	2591.246	-174.2877	-3202.995	3845.58**	2575.728
	cons.	(630.94)		(3309.13)	(4997.34)	(2364.17)	(4661.62)	(1300.21)	(3718.80)
28	share of migrants	2.17		-5.1559	-66.8933	19.6069	51.5938	-76.7517**	-47.6728
	unemployment	(13.50)		(60.72)	(97.86)	(43.03)	(92.94)	(26.00)	(60.08)
	GDP	0.7398***		0.3912**	0.0521	0.2414*	0.1879*	-0.9863***	-0.0767
	cons.	(0.04)		(0.13)	(0.15)	(0.11)	(0.09)	(0.12)	(0.12)
29	share of migrants	-119.7478***		52.1897	238.9159*	262.1739**	561.8259**	8.0344	122.7

The difference in proportions between the native and foreign-born (second generation migrants) against the proportion among the respective migrant population is plotted in Figure 4.6, Figure 4.7 and Figure 4.8. The negative relationship suggests that migrants are narrowing the gap with their native counterparts. For each difference and task classification between the respective subgroups, in all scatterplots, a downward trend is evident. The smaller the proportion of migrants engaging in a particular job task, the more pronounced the difference between natives and migrants. Conversely, as the proportion of migrants in that job task increases, the task-based disparity compared to natives diminishes, signifying a catch-up tendency. Figure 4.6, Figure 4.7 and Figure 4.8 also illustrate the 95% confidence intervals for the convergence regression. For the difference between natives and foreign-born as outlined in Figure 4.6, the coefficient for 'routine manual' is negative (-0.8651) and statistically significant ($p - value < .001$), similarly this holds true for 'routine cognitive' tasks (-0.8656 , $p - value < .001$). Moreover, for 'non-routine manual' (-1.0004 , $p - value < .001$) and for 'non-routine analytic' (-0.9083 , $p - value < .001$) the model yields negative and statistically significant coefficients respectively. In the context of the difference between the native and second generation migrant groups (Figure 4.7), the coefficients across all four tasks are negative and statistically significant: 'routine manual' (-0.9083 , $p - value < .001$); 'routine cognitive' (-0.9665 , $p - value < .001$); 'non-routine manual' (-0.9968 , $p - value < .001$) and 'non-routine analytic' (-0.8813 , $p - value < .001$). When exploring the disparity between foreign-born individuals and the second generation of migrants, a negative and statistically significant relationship indicating convergence between the respective groups is identified.

To reinforce the evidence provided by the aggregate level convergence regressions, Table 4.1 presents the preliminary results from the analysis of the convergence/divergence between the native and migrant populations applying the random coefficients model, as discussed in 4.4. The presented table shows the influence of the migrant population's proportion on the disparities within the four tasks when comparing native individuals with specific migrant populations. The aim is to discern patterns of convergence or divergence between these groups at the federal state level. Additionally, two control variables, namely the federal state unemployment rate and GDP growth, which were available at the federal state level for the analysed period have been included. Within each task a further distinction has been made between the native population and the specific migrant populations (foreign-born, second generation migrants). The columns labeled *N and F* within the table, demonstrate the effect of the proportion of foreign-born individuals within each respective federal state on the disparities observed between native individuals and the foreign-born population. Similarly, the columns labeled *N and 2nd* illustrate the impact of the second-generation migrant population's share on the variations between native-born

individuals and this specific migrant group, within the context of the federal state level. There are no findings presented in the fourth column that pertain to disparities between the native and second-generation migrant populations in non-routine manual work. The absence of results is due to collinearity issues that lead to the exclusion of certain variables.⁴

Firstly, there are remarkable differences between the new (East German) and the old (West German) federal states. In Mecklenburg, Sachsen, Sachsen-Anhalt and Thüringen there are more instances of a statistically significant divergence between the native and migrant populations. Exceptions are found for *routine cognitive* tasks among natives and 2nd generation migrants in Mecklenburg (-0.4007 , $p - value < 0.001$) natives and foreign-born in Sachsen-Anhalt (-0.9863 , $p - value < 0.001$) and Thüringen (-0.6168 , $p - value < 0.001$) where coefficients are statistically highly significant. In particular for *non-routine manual* occupations in Mecklenburg (0.7591 , $p - value < 0.001$), Sachsen (0.8044 , $p - value < 0.001$) and Sachsen-Anhalt (0.7398 , $p - value < 0.001$), the results imply statistically significant divergences among the native and foreign-born populations. Hamburg, NRW, Hessen, Bayern, Berlin, and Saarland exhibit the highest number of statistically significant instances of task-based convergence between native and migrant populations. Hessen, the federal state that is home to Frankfurt, the financial centre, displays the highest occurrences of convergence rates in most categories. However, in the case of *routine manual* tasks, there is a statistically significant divergence observed between natives and foreign-born individuals (1.0336 , $p - value < 0.001$), as well as between natives and second-generation migrants (0.7231 , $p - value < 0.001$). While a significant convergence in *non-routine manual* tasks (-0.4513 , $p - value < 0.01$) and *routine cognitive* for all groups is observed (-0.7682 , $p - value < 0.001$) and (-0.5289 , $p - value < 0.001$) in Berlin, the capital, there is no convergence in *non-routine analytic* tasks between the respective groups but rather a notable divergence (0.2729 , $p - value < 0.01$) between natives and second generation migrants. In several additional cases, statistically significant divergence is observed between natives and both migrant populations within *routine manual* tasks. These cases include NRW, Hessen, Baden-Wuerttemberg, Brandenburg, Berlin, Bayern, and Niedersachsen. In the context of *non-routine analytic* tasks, which are increasingly in demand in the labour market due to advancements in artificial intelligence and related technologies, NRW, Hessen, Baden-Wuerttemberg, and Hamburg show statistically significant convergence over time between native and migrant workers. This result suggests a narrowing gap and the attainment of similar occupational outcomes between native and migrant workers in *non-routine analytic*

⁴ In order to comply with the extended throughput regression with correction method (stata: *xtrc*), it is crucial to successfully apply OLS regression to each panel without the need of excluding variables due to collinearity.

work.

4.6 Discussion

The results suggest a trend towards cognitive task-based occupations, a convergence of occupational patterns between migrants and native Germans across various job tasks on the aggregate level and regional disparities in convergence/divergence among sub-populations across federal states. Nevertheless, prior to reaching conclusions or proposing practical recommendations, it is imperative to consider the perspectives of [Rohrbach-Schmidt and Tiemann \(2013\)](#). The author shows that the understanding of longitudinal trends in routine and non-routine work is largely dependent on how task variables are initially defined and measured. Further, given the reduced number of control variables at the federal state level, the accuracy of some findings could be compromised and might not fully account for the uncontrolled factors that may influence the observed relationships. To address this limitation, future research could consider expanding the set of control variables at the federal state level to provide a more comprehensive and accurate understanding of the studied phenomena.

In our examination of regional disparities in Germany, the findings resonate with the insights conveyed in the uplifting book 'Streets of Gold' by [Abramitzky and Boustan \(2022\)](#). The authors emphasise a positive narrative, indicating that while earlier waves of immigrants faced challenges in catching up with native-born Americans in terms of occupational outcomes, more recent migrant cohorts and subsequent generations have narrowed the gap. A salient factor contributing to the increased upward mobility of these immigrants driven by the pursuit of economic opportunities is the strategic selection of regions with better economic prospects. Historically, this meant settling in urban areas with manufacturing jobs as opposed to those shaped by agriculture. Even today, in contrast to US-born individuals who are more often rooted in places due to social ties, migrants are more flexible to relocate in search of opportunities. The interplay between immigrants' strategic settlement choices and the resulting dynamics in regional economic disparities (for Germany see for example, [Heider et al. \(2020\)](#) or [Lehmann and Nagl \(2019\)](#)) underscore the profound impact of settlement decisions on the convergence or divergence between migrants and natives over time, which is reflected in our results. While [Abramitzky and Boustan \(2022\)](#) accentuate migrants upward mobility, scrutinising the occupational job task trajectories in the US, [Cassidy \(2019\)](#) reports a growing immigrant-native gap, showing that immigrants typically have lower analytical and interactive task requirements compared to their native counterparts and are more often found in occupations requiring manual tasks. Controlling for cohort effects, the study finds an occupational assimilation

for earlier migrant cohorts over time, with slower assimilation rates found among newer cohorts.

4.7 Conclusion

This article introduces a task-based model on German household data (1985-2020) to explore occupational discrepancies between the native and migrant populations on the aggregate, using convergence type regressions and random coefficient models at the regional federal state level. Looking into routine manual, routine cognitive, non-routine manual and non-routine analytic tasks the results indicate an aggregate level convergence between native, foreign-born and second-generation migrants as well as a narrowing gap between foreign-born and second generation migrants in Germany. Extending the analysis to the regional level, the findings uncover regional variations with less pronounced convergence observed in East Germany compared to the Western federal states. This can be attributed to factors such as the interplay of capital, skills and knowledge, circular migration and migration regimes along with technological advancement as outlined by [Williams \(2009\)](#). Several limitations of the current study need to be considered, particularly those challenges underscored by [Rohrbach-Schmidt and Tiemann \(2013\)](#) in categorising tasks into distinct domains. These challenges stem from differences in data collection methods, shifts in survey populations, alterations in study content and fluctuations in the task items themselves across various survey waves, rendering the classification process a challenging endeavour.

Figures and Tables

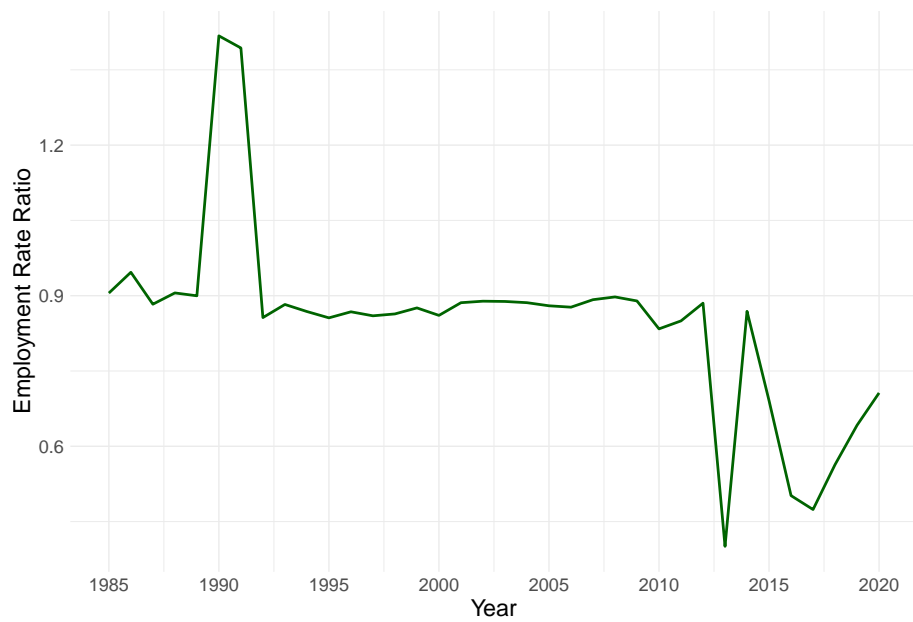


Figure 4.1: Employment rate ratio: Foreign vs Native-born

Data: SOEP v37

The measurement of the employment rate ratio involves estimating the employment rate among foreign-born individuals relative to that among native-born individuals.

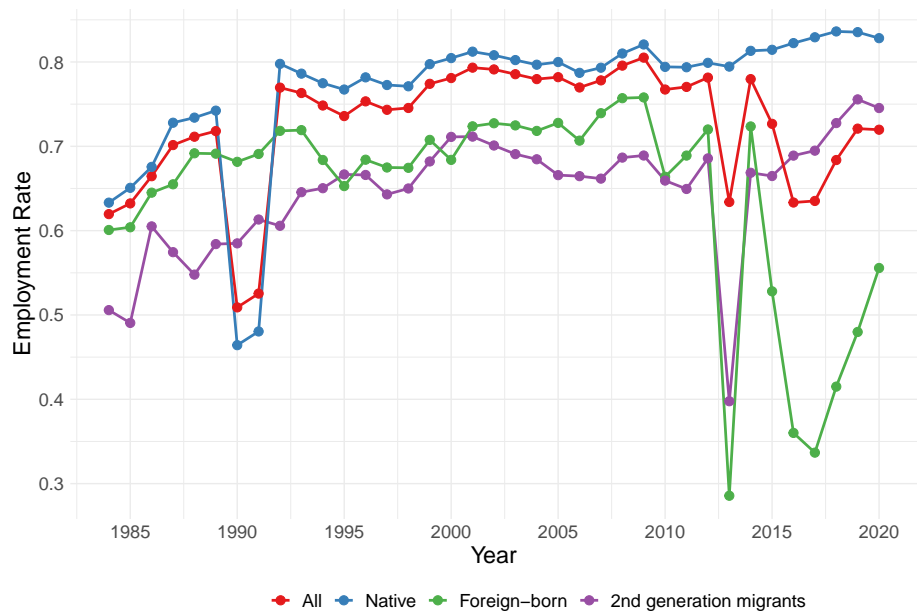


Figure 4.2: Employment rate dynamics

Data: SOEP v37

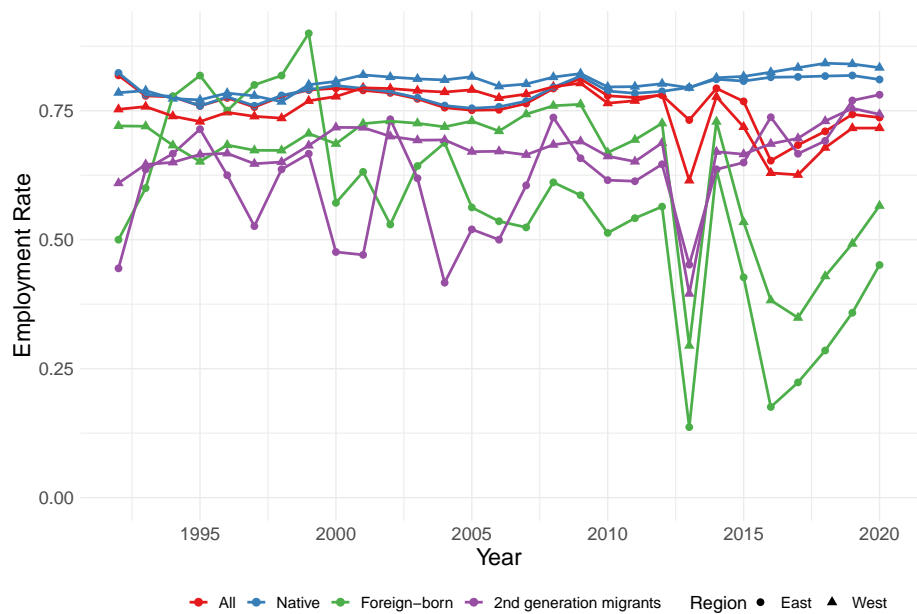


Figure 4.3: Regional employment rate dynamics

Data: SOEP v37

Note that before 1992, the data was not available for 5 federal states that were in GDR before reunification. The data was also not available for the federal state of Saarland until 2001.

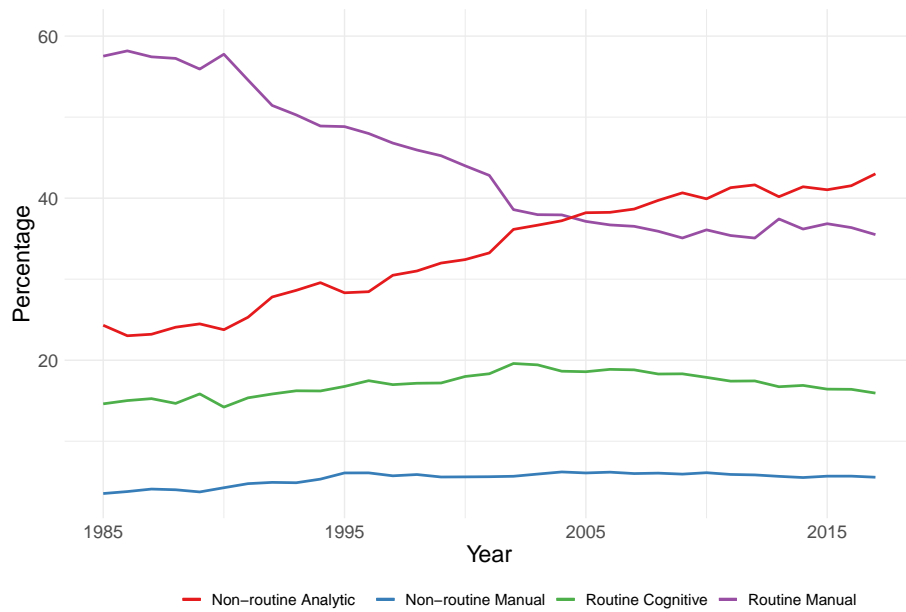


Figure 4.4: Evolution of job tasks

Data: SOEP v37

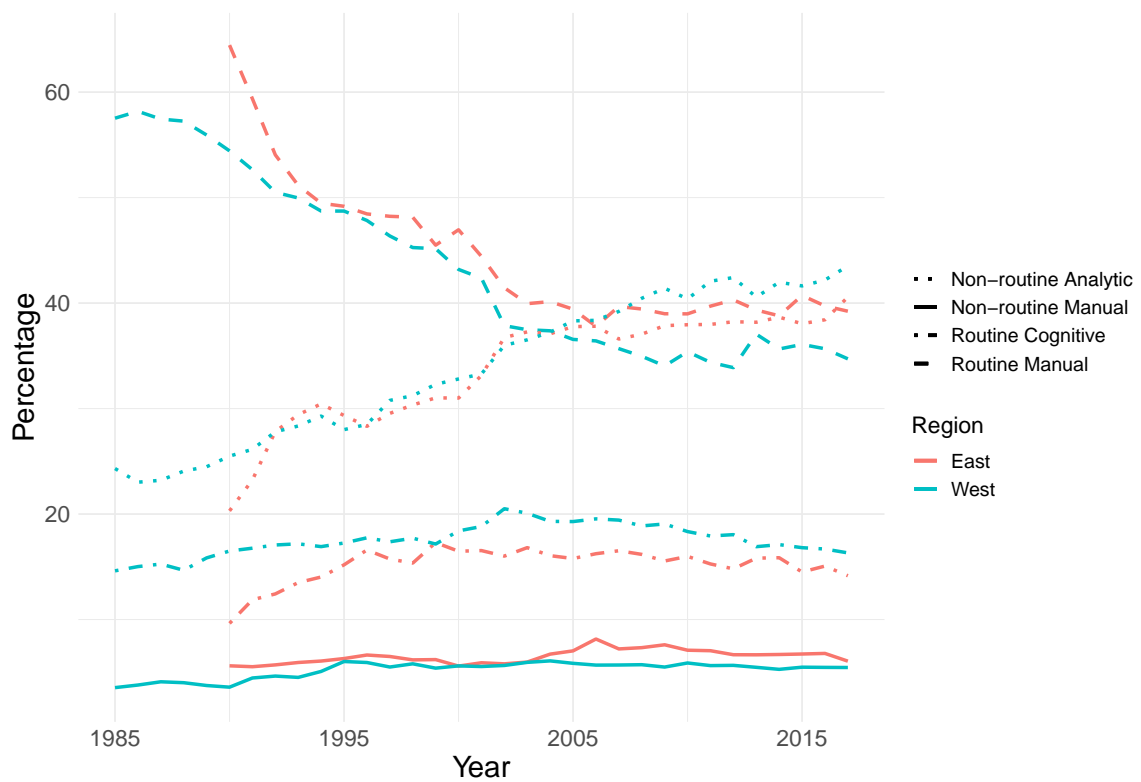


Figure 4.5: Regional evolution of job tasks

Data: SOEP v37

Note that before 1992, the data was not available for 5 federal states that were in GDR before reunification. The data was also not available for the federal state of Saarland until 2001.

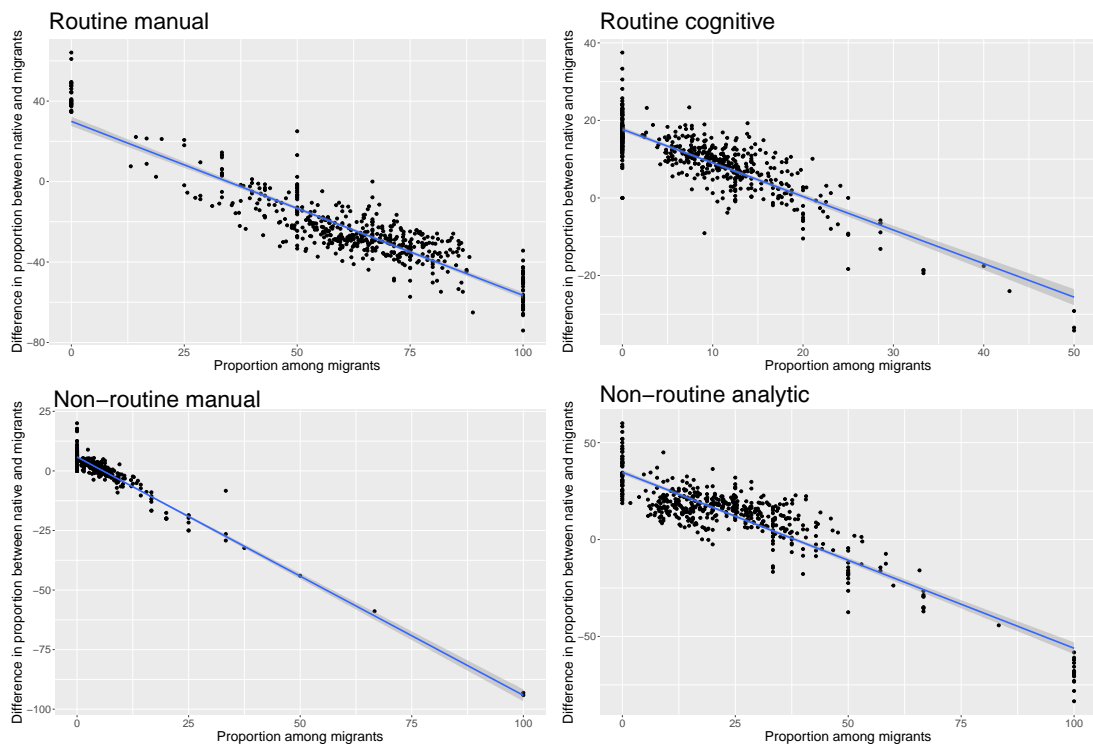


Figure 4.6: Natives and foreign-born across tasks

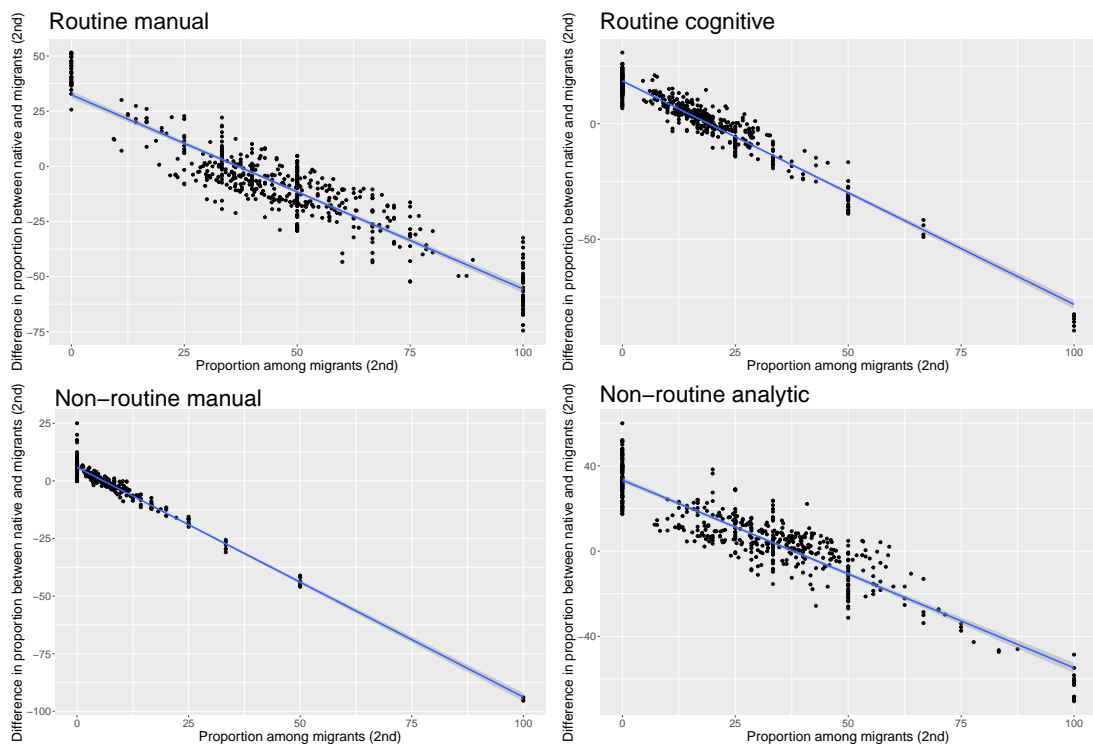


Figure 4.7: Natives and 2nd-generation migrants across tasks

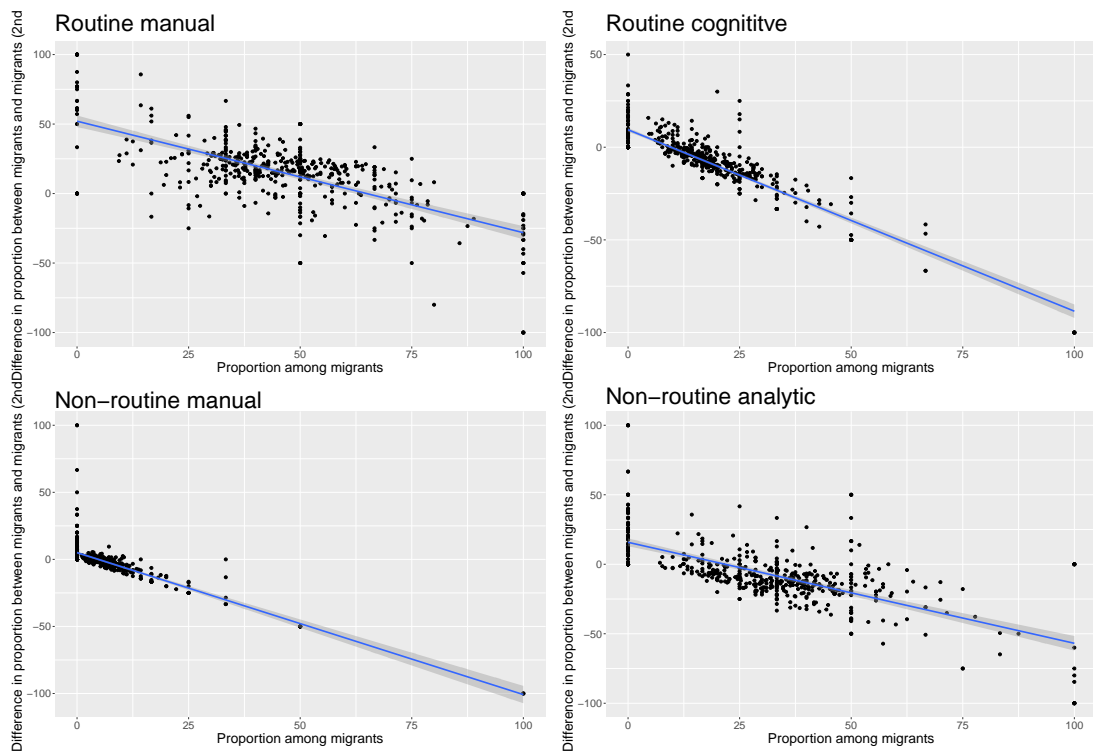


Figure 4.8: Foreign-born and 2nd-generation migrants across tasks

Chapter 5

Conclusion

The evidence presented in the scope of three separate studies reveals a promising convergence between the migrant and native population, marked by several positive socio-economic developments where migrants substantively contribute to the overall economy. Yet, this research reveals regional heterogeneity, notably observed between East and West German federal states, aligning with the existing literature (e.g., [Tanis \(2018\)](#), [Lehmann and Nagl \(2019\)](#), [Heider et al. \(2020\)](#)). Despite migrants' socio-economic advancements, prevailing narratives surrounding migrants remain resistant to change, perpetuating stereotypes and misconceptions in the public debate. While acknowledging the challenges imposed by migration (see for example, [Algan et al. \(2010\)](#), [Kogan \(2011\)](#), [Romiti et al. \(2015\)](#) and [Brücker et al. \(2021\)](#) on complexities of societal and labour market integration), it is imperative to elucidate the tangible socio-economic contributions made by migrants in Germany. This calls for a paradigm shift in the public discourse accompanied with several policy considerations, including the promotion of a positive public discourse by developing campaigns that confront and discredit bigotry related to migration, encourage dialogue between migrants and the broader society along with educational programmes and training in schools and organisations that embrace a culture of inclusion and multiculturalism. Further, research initiatives and partnerships among municipalities, non-profit and private sector organisations have the vigour to promote multicultural sensitivity and opportunities for continuous learning to ascertain that both natives and migrants are equipped for changing labour market demands (e.g., [Acemoglu and Loebbing \(2022\)](#)).

Results provided in Essay 1 based on Platform X data, underscore that negative attitudes exceed the positive, additionally narrative sentiments remain constant over time and unaffected by the real economic impact of migrants in Germany. This is compelling, as it shows how profound historic notions are entrenched into the mind and beliefs of society. The study tests the hypothesis whether migrants drive economic inequality in Germany measured by income inequality parameters. The em-

pirical findings, derived from the analysis of SOEP data spanning from 1985 to 2015, in conjunction with Platform X data, emphasise that neither the proportion of migrants nor their positioning within the income distribution at the federal state level, nor the percentage of highly or lowly educated migrants, along with narrative sentiments reflecting societal socio-economic status, can account for the observed increase in economic inequality levels, examined by the Gini and Palma ratios. The empirical contribution drawing upon household panel and social media data applying both econometric and natural language processing techniques are unique in the German context. The results encourage continuous efforts to narrow the gap in education, occupation and income between natives and migrants while monitoring and evaluating the effectiveness of integration policies to ensure successful/sustainable outcomes.

Essay 2 proposes a multivariate method to estimate multidimensional vulnerability of households and its determinants beyond pecuniary terms. There have been multiple attempts to quantify vulnerability (e.g., [Ligon and Schechter \(2003\)](#), [Dutta et al. \(2011\)](#)), this research is unique in its attempt to compute and address household level vulnerabilities beyond consumption and income. Secondly, the purpose is to construct indices of three dimensions (health, employment and housing) that allow inter-household comparison. The essay concludes with an empirical application using the German SOEP data. Interacting migration status with income to understand how different migrant groups experience and respond to vulnerability, the results reveal that mixed households show lower vulnerability than natives, while non-native households are the most vulnerable in this context. No substantial differences in health and employment achievements among native, non-native and mixed households are observed, yet non-native households are found to be the most disadvantaged in terms of housing achievements which confirms results found in the literature ([Clark et al. 2001](#), [Auspurg et al. 2017](#)). Regional disparities across federal states prevail, promoting further research endeavours addressing the underlying causes of this heterogeneity to ensure equitable access to opportunities and resources.

The third essay examines job-task related dynamics between the native, foreign-born and second generation migrant populations on both the federal state and aggregate levels. In the German context, this study marks the initial effort to explore task-based employment prospects between different sub-populations. Aggregate level results highlight convergence in all job-task categories, however regional level discrepancies between East and West Germany prevail, reinforcing the contributions of the first essay, finding that income inequity levels in East Germany exceed those observed in the West. In order to mitigate these regional disparities, it is crucial to foster collaboration between non-profit and private sector entities, facilitating the sharing of best practices. Additionally, implementing upskilling programmes that recognise the distinct skill distribution between migrants and natives is essential. Si-

multaneously, reducing bureaucratic efforts and streamlining processes for skill and degree recognition is vital. Encouraging employers to integrate language training into their on-boarding processes and fostering collaboration between municipalities and businesses to create targeted internships and vocational training opportunities for migrants, will substantially contribute to these efforts.

To conclude, there is a catch-up between natives and migrants in terms of education, employment and occupation in Germany, however regional variations persist. The results presented in this thesis indicate the potential for initiating a paradigm shift. Building upon the findings established in the preceding papers, the focus shifts towards the practical application of the empirical evidence by outlining specific policy recommendations directly addressing the identified issues. In the realm of migration, public policy and societal perceptions, collaborative work between policymakers, academics and the media is pivotal in disseminating accurate information. To reshape collective beliefs, it is vital to engage with the media and implement public awareness campaigns grounded on empirical evidence. In addition, it is important to disseminate accurate, evidence-based information about the economic surplus brought by migrants. Further, collaborative initiatives among different stakeholders can mitigate misconceptions and challenge stereotypes, thereby promoting a more positive public opinion on migrants. This is vital for migrants to be recognised as permanent and integral members of society. Another aspect policymakers should advocate for is the implementation of inclusive workforce policies that leverage and focus on the skills and talents of migrants. This could include tailored programmes for language acquisition, skill development and cultural integration, ultimately fostering the overall productivity and contributions of migrants to the German economy.

Appendix A

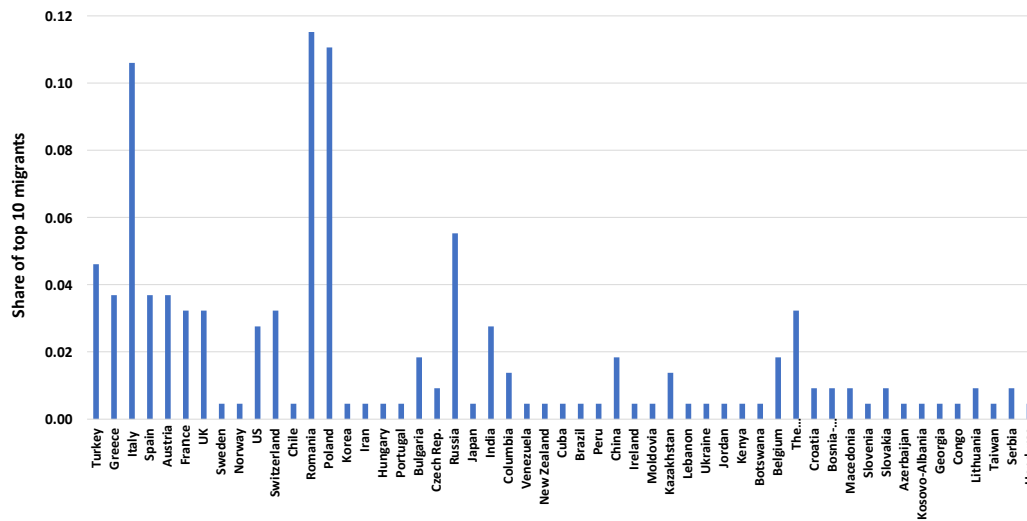


Figure 5.1: Origin of Top 10% Migrants in 2015

Notes: Year 2015.

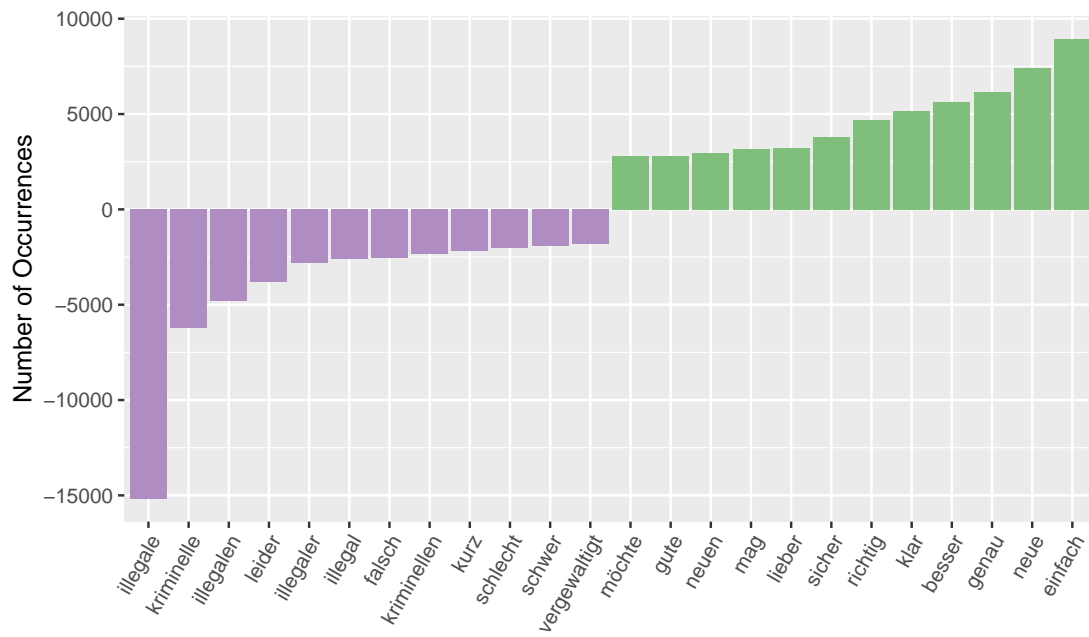


Figure 5.2: Most common Positive and Negative words

Table 5.1: Gini Coefficient and shares of different groups of migrant, year 2000

Federal State	Gini	Share of Foreign-born	Share in migrant population of	
			Low skilled	Highly skilled
Schleswig-Holstein	0.298	0.370	0.063	
Hamburg	0.312	0.111	0.452	0.065
Lower Saxony	0.277	0.135	0.336	0.050
Bremen	0.270	0.130	0.380	0.080
North Rhine-Westphalia	0.283	0.179	0.454	0.069
Hesse	0.290	0.209	0.394	0.105
Rhineland-Palatinate	0.252	0.160	0.456	0.040
Baden-Württemberg	0.262	0.275	0.530	0.041
Bavaria	0.276	0.146	0.445	0.063
Saarland	0.256	0.166	0.552	0.029
Berlin	0.293	0.127	0.228	0.102
Mecklenburg-West Pomerania	0.258	0.019	0.257	0.286
Brandenburg	0.286	0.028	0.306	0.139
Saxony-Anhalt	0.256	0.022	0.361	0.181
Thuringia	0.260	0.033	0.525	0.148
Saxony	0.254	0.020	0.395	0.132

Notes: East German states are at the bottom part of the table.

Source: SOEP, v.35; own calculations.

Appendix B

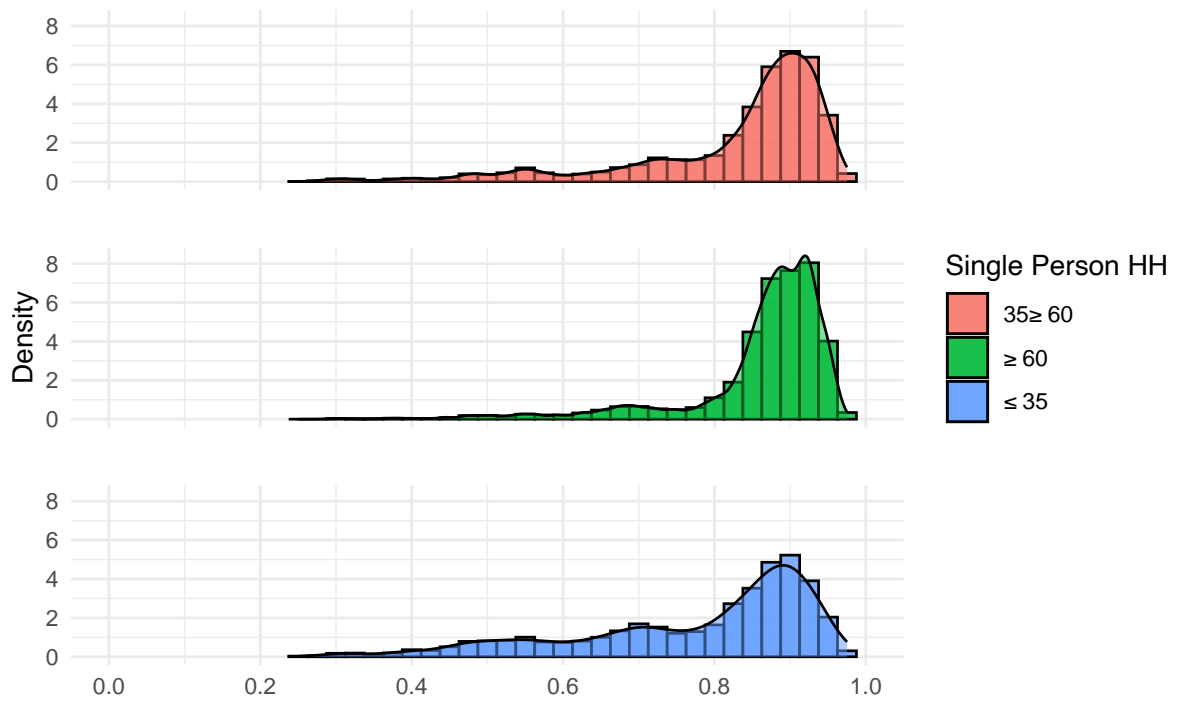


Figure 5.3: Single Household potential by Age

Notes: distribution of households' potential, classified by age

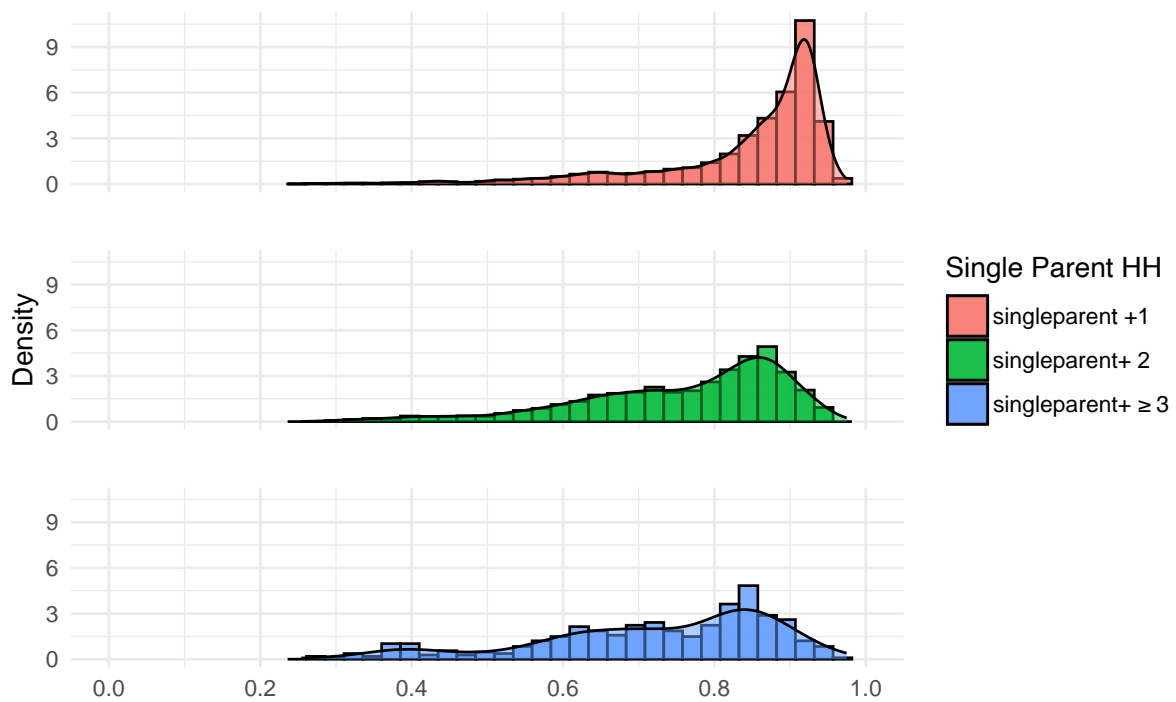


Figure 5.4: Single Parent Household potential

Notes: distribution of households' potential, number of children living in household

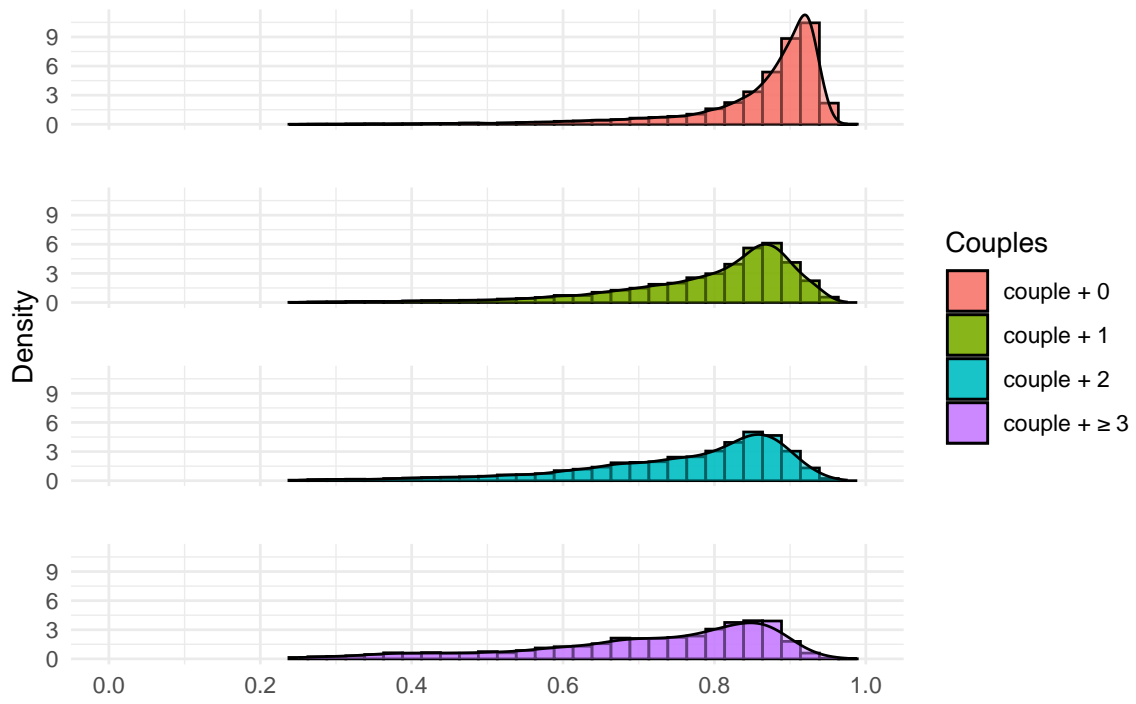


Figure 5.5: Couples Household potential

Notes: distribution of households' potential, number of children living in household

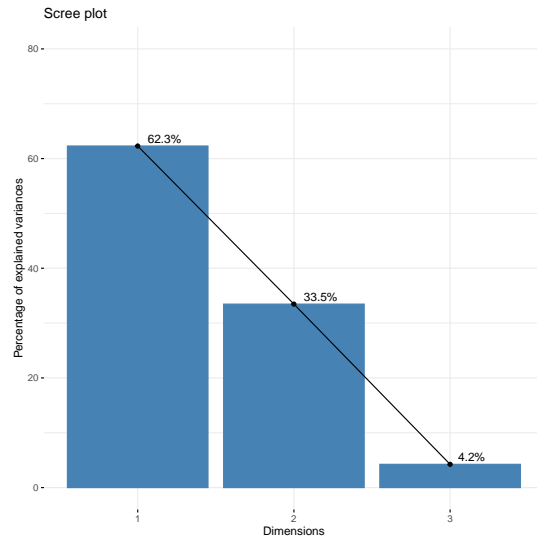
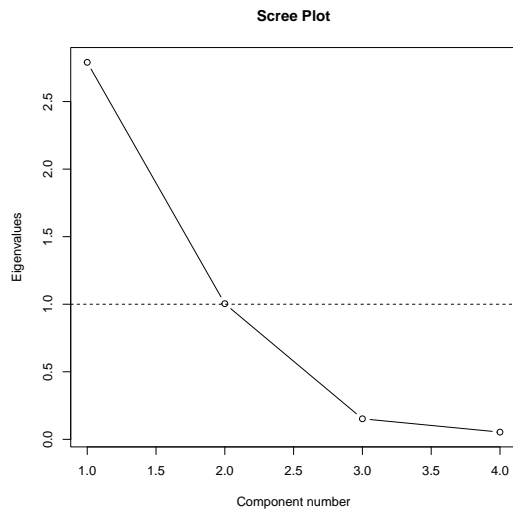


Figure 5.6: Screeplot: PCA Analysis Employment

Notes: Left: Screeplot Employment

right: Explained variance: Employment

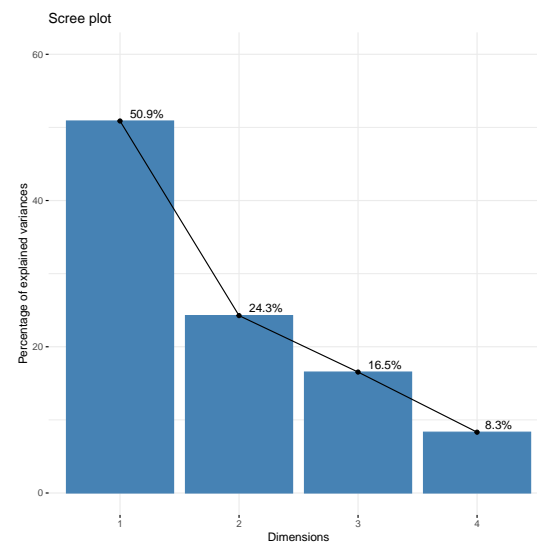
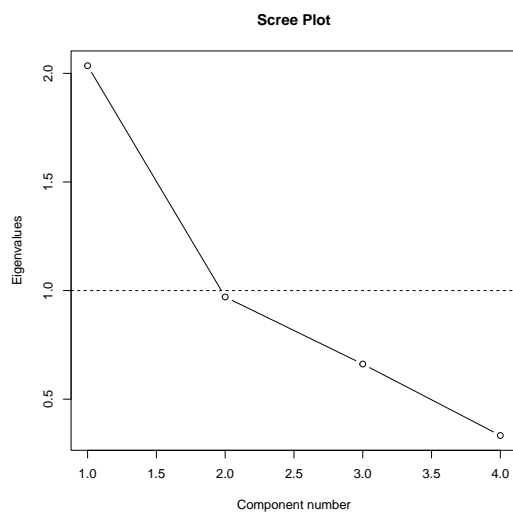


Figure 5.7: Screeplot: PCA Analysis Housing

Notes: Left: Screeplot Housing

right: Explained variance: Housing

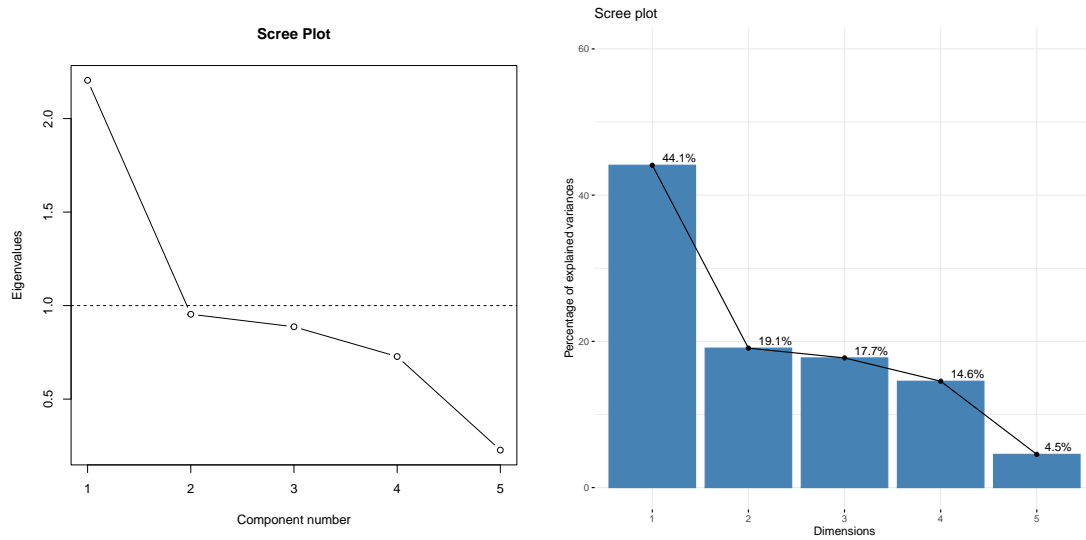


Figure 5.8: Screeplot: PCA Analysis Health

Notes: Left: Screeplot Health

right: Explained variance: Health

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