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IZA DP No. 16749

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ABSTRACT

The Effect of Migration on Careers of Natives: Evidence from Long-Term Care*

This paper examines the effect of increasing foreign staffing on the labor market outcomes of native workers in the German long-term care sector. Using administrative social security data covering the universe of long-term care workers and policy-induced exogenous variation, we find that increased foreign staffing reduces labor shortages but has diverging implications for the careers of native workers in the sector. While it causes a transition of those currently employed to jobs with better working conditions, higher wages, and non-manual tasks, it simultaneously diminishes re-employment prospects for the unemployed natives with LTC experience.

JEL Classification: J61, I11

Keywords: immigration, shift-share instrument, long-term care, EU enlargement

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1 Introduction

Across OECD countries, the proportion of individuals aged 80 and above is projected to double from five to ten percent of the population by 2050 (OECD, 2020). This rapid population aging has sizable implications for the demand and provision of long-term care (LTC). Even in 2020, the supply of LTC workers in nursing homes, assisted living facilities, and in patients' homes is struggling to keep pace with the escalating demand (OECD, 2020). Informal care by family members is also unlikely to fill these shortages: the number of potential family caregivers will decrease because of lower birth rates, higher female labor force participation, and postponed retirement entry (Fujisawa and Colombo, 2009, Fischer and Müller, 2020). Consequently, the LTC sector is grappling with a persistent scarcity of labor, evident, for example, in Germany where care giving roles are among the most urgent positions to be filled.

A common approach adopted by policymakers to address labor shortages, both in general and particularly in the LTC sector, involves increasing the inflow of working migrants.[1] To understand the potential of such policies for the organization of LTC, it is crucial to examine their impact on the labor market outcomes of the native care workers. Firstly, the sign and size of the effect on the regional native employment determines how additional migrant workers affect scarcity in the local care sector. Secondly, the inflow of working migrants has a direct effect on the careers of the incumbent workforce. On the one hand, foreign labor may displace the native personnel away from the LTC sector, into unemployment or lower-quality jobs. On the other hand, their arrival could also facilitate native promotions and transitions to roles with higher pay and better working conditions. These career effects can be persistent and long-lasting, potentially differing between individuals by qualification or type of care provided. Finally, the inflow of working migrants may further influence the job prospects for the unemployed who have the relevant experience in LTC and are considering (re-)entering the LTC sector. Thus, to evaluate the success of migration policies in the care sector, it is necessary to quantify both

[1] For a summary of the debate in Germany, see Barisic et al., 2023.

the overall local labor market effects as well as the heterogeneous implications for individual careers.

In this paper, we exploit exogenous policy variation to provide evidence on the effect of foreign staffing on the labor market outcomes of native workers in the LTC sector. In doing so, we adopt a two-fold approach. Our first step involves quantifying the effect of an increase in foreign LTC staffing on the regional employment of native care workers. We then move on to study the long-run implications for the natives' careers, as measured by a wide range of outcomes, including occupational changes, wage progression, differences in psychological and physical working conditions, as well as transitions in the type of tasks performed at work. Importantly, we distinguish between two types of workers: the *insiders*, employed in the LTC sector, and the *outsiders*, who are unemployed but have relevant LTC work experience. This distinction is crucial given that migrant workers may primarily reduce native worker inflows into employment, rather than increasing outflows from employment, as shown in e.g. Federman et al., 2006, Dustmann et al., 2017.

The analysis is based on administrative social security data, in which we observe the universe of migrant and native care workers in Germany. In addition to including their full employment and earnings histories, the data also provides detailed account of their job characteristics, including occupation, industry, and career levels. This allows us to further explore the potentially diverging effects of migration on insiders versus outsiders across various dimensions, including their formal qualification and the type of care provided by the insiders, as well as by unemployment duration and time spent out of the LTC sector for the outsiders.

For the identification, we exploit exogenous variation induced by reforms in migration policy in Germany to construct a plausibly exogenous shift-share instrument. Reforms of the migration rules removed restrictions in access to the labor market for the newly admitted EU states, mostly from Eastern Europe, in three consecutive rounds in 2011, 2014, and 2015. In turn, this stepwise market opening differentially affected German regions, generating significant regional and time variation in migrant entry. In recent years,

a number of papers have highlighted issues related to the widespread usage of shift-share instruments (e.g. Jaeger et al., 2018, Goldsmith-Pinkham et al., 2020), Borusyak et al., 2022. In our setting, we think of the instrument as plausibly satisfying the exogeneity-of-shares assumption, as proposed by Goldsmith-Pinkham et al., 2020. We put this assumption to test and provide evidence that rejects significance of a number of alternative channels through which historical shares could influence contemporaneous outcomes in LTC. Furthermore, we descriptively show that the exogenous policy changes have led to a substantial variation in the composition of the incoming migrant pool, thereby reducing the potential for serial correlation in the instrumented inflows, a concern raised by Jaeger et al., 2018. We then perform a formal test of this serial correlation, which shows that the results are not conflating short- and long-term responses to migrants taking up LTC work. Finally, we propose an alternative shift-share instrument that directly leverages the policy variation, inspired by Tabellini, 2020. Compared to a standard shift-share design, this instrument yields quantitatively similar effects, providing further evidence that our results are mainly driven by exogenous labor market openings and the arrival of migrants from the new EU Member States after 2011.

Our analysis leads to the following findings. In terms of the overall regional effect, we find that ten foreign workers displace about four to five native employees in the LTC sector. This implies that the total number of workers in the sector increases, thereby reducing shortages. Importantly, migration into LTC has sizeable effects on the native careers. Focusing on the career implications for the insiders, our study reveals that higher regional foreign inflows push natives to change jobs to ones that feature higher wages, are non-manual (instead cognitive or analytical), and are characterized by lower physical and psychological occupational demand. Conversely, we find negative effects for the outsiders. In high-migration regions, outsiders are less likely to become re-employed in LTC and more likely to stay unemployed altogether. A further heterogeneity analysis reveals that, upon an increase in the foreign LTC staffing, highly skilled nurses and workers of outpatient services see the greatest benefits to their career trajectories, whereas the most adverse effects are

faced by nursing assistants and those recently unemployed. Overall, our study shows that, in line with the literature, the effects of migration on insiders versus outsiders of the sector are vastly divergent. With this analysis, we provide novel evidence by explicitly quantifying the effect of migration on outcomes of workers who could be re-employed in the sector at a relatively low cost, given their already-acquired training and work experience.

Our work relates to the broad literature on the labor market effects of immigration (see Lewis and Peri, 2015, Dustmann et al., 2016, Edo, 2019 for reviews of literature). Previous studies also explore the question of the effect of migration on careers of natives more specifically. They focus on the insider groups and feature multiple career outcomes such as promotion, unemployment, wage or earnings, promotions and task change (Cattaneo et al., 2015, Foged and Peri, 2016, Beerli et al., 2021). We extend this list by looking at the changes in occupational strain, a dimension reflecting working conditions, when moving jobs. Importantly, however, we contribute to this strand of literature by being the first to investigate the effect of migrant workers on the careers of the outsiders.

Furthermore, a number of studies focus on the impact of migration on natives working in health and care sectors. For the case of registered nurses, Schumacher, 2011 and Kaestner and Kaushal, 2012 find minimal impact of foreign-trained nurses on the US nurses' earnings. Cortés and Pan, 2014, however, note a significant job displacement of native nurses by immigrant nurses, which they link to a deteriorating work environment rather than wage changes.[2] To the best of our knowledge, the only literature specifically investigating the effects of migration in the formal LTC sector are the works by Furtado and Ortega, 2023 and Grabowski et al., 2023. In both cases, the authors show that immigration increases the quality of care in US nursing homes, with increases in staffing being the primary mechanism. We believe that we complement these studies in several ways. We explore the effects of

[2]In terms of the impact on care quality, Castro-Pires et al., 2023 find that a decrease in the inflow of foreign nurses caused by Brexit led to an increase in admission rates to English hospitals.

the precisely-measured migration *into the LTC sector*, as opposed to measuring the impact of overall (female) migration, irrespective of the taken-up occupation. Furthermore, thanks to the detailed employer information, we are able to consider labor market outcomes of native workers who provide care at patients' home, without limiting the analysis to nursing homes only. However, we believe that the most distinguishing feature of our study lies in the ability to investigate the direction and timing of the changes in career trajectories of the native insiders and outsiders.

2 Data

The underlying source of our main dataset is a German administrative register, managed by the Federal Employment Agency, that contains employment and earnings histories of all workers in Germany who are subject to social security contributions. To identify episodes of LTC work, we look for employment episodes satisfying two criteria: i) a nurse, nursing assistant, or care worker, indicated as the performed occupation; ii) residential nursing care activities, social work without accommodation for elderly and disabled, and residential care for the elderly and disabled, indicated as the employer industry.[3] Having identified all individuals with at least one such episode between 2005 and 2019, we record their full employment histories, including unemployment spells or work outside the LTC sector.[4] This procedure brings together the universe of LTC workers in Germany, defining the main dataset used in the analysis.

Importantly for our purposes, each (un)employment episode further notes the region of residence,[5] as well as a range of personal characteristics, such as

[3]These occupations are reflected by the KlDB 1998 codes: 853, 854 and 861, and the industries are contained in these WZ 2008 codes: 871, 873, 881. Due to a change in occupational code classification, occupational codes for some individuals were imputed - please see Appendix A2 for details.

[4]Throughout the paper, we use the term *LTC sector* to signify a collective of workers who are employed as LTC workers. That is, the term does not include other occupations that could potentially work in this industry, such as office administration of nursing homes, or cooks.

[5]Throughout this paper, we refer to the German *Landkreise* and *Stadtkreise* as regions and to the German *Länder* as states.

birth year, gender, and nationality. We rely on the final attribute to distinguish between native and foreign workers, as well as to assign foreign workers to a country-of-origin group.[6] Given that nationalities may in principle change over time, e.g. due to naturalization, we define a *migrant* as a person who was reported as having a non-German nationality in the first (un)employment episode we observe. The same first nationality is then used to allocate workers across the countries of origin. For further details on the *migrant* definition, please see Appendix A3. There, we also document that our findings are robust to changes in this definition.

We complement the social security data with additional data sources: i) administrative data on LTC provision (*Pflegestatistik*), which includes regional information about the number of care recipients and type of care provided; ii) regional variables capturing population and labor market characteristics, provided by from the German Statistical Office; iii) the occupational demand index proposed by Kroll, 2011; and, finally, iv) a dataset linking occupational codes to the nature of tasks performed at work by Dengler et al., 2014. We describe these sources in detail in Appendix A1.

We combine the above data to construct various indicators that reflect both the local labor market employment in the LTC sector and the specific career outcomes of those natives employed in the sector. We present the sample definition and the construction of the main variables used in the regional analysis and the analysis of native careers below.

Regional staffing analysis: main variables

Thanks to the administrative nature of the main dataset, we are able to build precise indicators of regional employment in the LTC sector. We construct a yearly regional panel, covering 2005 through 2019. For each region-year cell, we count the exact stock of natives and foreigners employed in LTC. We combine these counts with information on the regional elderly population (above 75 years of age) in a ratio to construct our main outcome and explanatory variables: native and foreign staff-to-elderly ratios. The variables allow us to

[6] The words *migrant* and *foreigner* are used interchangeably.

capture changes in the regional staffing intensity, while controlling for differential *levels* of the regional population most likely to need LTC. However, to prevent *changes* in the elderly counts affecting our results, we fix the denominator to the base year 2005.[7]

Native careers analysis: main variables

The data also allow us to observe the evolution of individual careers, thus measuring changes in sectors, pay, working conditions, nature of tasks performed, as well as transitions in and out of unemployment. Importantly, we distinguish two groups of workers, henceforth referred to *insiders* and *outsiders*. The insiders are workers who are employed as LTC workers at a given point in time. The outsider group are unemployed with employment spells in the LTC sector in the past.

To limit compositional changes driving the results of the native careers analysis, we use a specific subset of the main dataset. In particular, we focus on all individuals who were i) LTC workers and ii) unemployed but with recent[8] care work experience in the year 2010. We then follow their careers through 2019, while holding their region of residence fixed. The choice to construct the samples with the baseline in 2010 is intentional. As explained in detail in Section 3, 2010 is the final year before the first labor market opening that is the main source of exogenous variation in our analysis.[9] Following this procedure results in 596,612 insiders and 43,719 outsiders. We encode their employment histories into the following outcomes on the level of group-region-year to measure career transitions and, in the case of the insiders, job characteristics.[10]

Each year, we observe the workers in one of four basic states: i) providing

[7] Our results are robust to alternative definitions of the ratios, see Appendix C1.

[8] The exact condition is at least one episode of LTC work between 2005 until 2010.

[9] We check for evidence of endogeneity due to insider/outsider sample selection in Section 4.4 and find no evidence of it.

[10] Since the proposed outcomes represent changes relative to the characteristics of a job held in 2010, we exclude the outsider sample when discussing the impact of immigration on job features. For demographic and employment characteristics of insiders and outsiders, see Table B.1.

LTC; ii) having a job outside of LTC; iii) being unemployed; or iv) dropping out of the sample. The final state, henceforth called *other transitions*, implies that the worker is no longer employed by a social-security paying employer and, therefore, could become self-employed, a civil servant, pursue full-time education, exit the labor force, become retired, or have passed away.

We use the job demand and occupational task indices to track physical and psychological strain associated with the natives' jobs over time. This allows us to create a panel of regional shares of workers in occupations with equal or higher physical or psychological job demand compared to care work. In a similar manner, we construct shares of workers who perform jobs involving one of the five main task types.

Finally, for each individual, we record the change in log monthly earnings between a given year and the base year, 2010.[11] Then, following the approach from above, we create a regional panel by averaging these differences among groups of workers in the same locality. Importantly, we pool the pay of those who stayed and left the LTC sector together, which eliminates selection bias associated with the decision to either stay in or leave LTC employment over time.

3 Institutional setting

The long-term care system in Germany

The LTC system in Germany operates on a pay-as-you-go basis and provides co-payment options for both formal ambulatory and residential care services and cash benefits for informal care. The allocated amounts are determined by the extent of impairment and the specific type of care or facility required.[12] In addition to formal care, informal care plays an important role, where cash benefits are given to the care-dependent individuals.

[11] We do not observe the earnings of those who exit the sample. However, as shown in Section 5, we find no relationship between increases in foreign staffing and sample exit. Therefore, sample attrition is unlikely to play a meaningful role in driving the wage results.

[12] For a more comprehensive understanding of this system, see Schmitz and Westphal, 2017 or Geyer et al., 2023.

The recently observed surge in demand for LTC underscores the need for effective staffing solutions. The number of care recipients increased from approximately 1.05 million in 2005 to 1.63 million in 2019, marking a significant 55% growth (Destatis, 2022b). Official forecasts predict a continued rise in both inpatient and outpatient care needs, with total demand stabilizing at around 2.6 million by 2070, which will be 3.6% of the projected population (Destatis, 2022c). Combining this with the predicted number of informal care-recipients, over 8% of the total German population will need some type of LTC in 2070.[13]

The German LTC sector is facing a significant worker supply shortage. The LTC worker occupation stands out as the number one in-demand occupation on the official list of missing highly-skilled workers, as reported by the government (Bundesagentur für Arbeit, 2020). Beyond wages, this issue may stem from inadequate working conditions, which could impact health outcomes of the workers in the sector (Rapp et al., 2021). The sector employs two categories of workers: trained nurses, requiring a standardized three-year vocational training, and assistants, with varying educational requirements across states. This translates into salary differences, with trained care workers earning more than assistants.[14] The sector is mostly ununionized (Boulhol and De Tavernier, 2023). A state-specific minimum wage for care work was introduced in 2010.[15]

Enlargement of the European Union

The expansion of the European Union after 2000 and its consequences have played a major role in the supply of care workers and serve as the main source of exogenous variation in our analysis. This enlargement had three rounds

[13]For the full historical and projected evolution of the number of care recipients, see Appendix Figure B.1.

[14]A female care worker with vocational training currently earns on average €3267 euros gross per month in Berlin; a female care assistant without such training earns €2728. The salaries are taken from a salary calculator (Gehaltsrechner) developed by the German Statistical Office, last accessed on August 29, 2023.

[15]Pflegearbeitsbedingungenverordnung, § 2, 15 July 2010.

and covered thirteen countries, henceforth referred to as the new Member States (NMS). The first round took place in 2004 and included ten countries: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia. In 2007, the EU integrated Romania and Bulgaria. Most recently, in 2013, Croatia became a member. However, while the incumbent EU states cannot restrict entry and residence, they are allowed to delay granting the new EU members access to their labor markets for up to seven years (Fihel et al., 2015). With the exception of the UK, Ireland, and Sweden, most countries exercised the right to this transition period. Accordingly, Germany opened its labor market to the three sets of new members only in 2011, 2014, and 2015, respectively.[16] Consequently, immigration from the NMS increased sharply after 2011, driven by income differentials in the now-shared labor market (Dorn and Zweimüller, 2021).

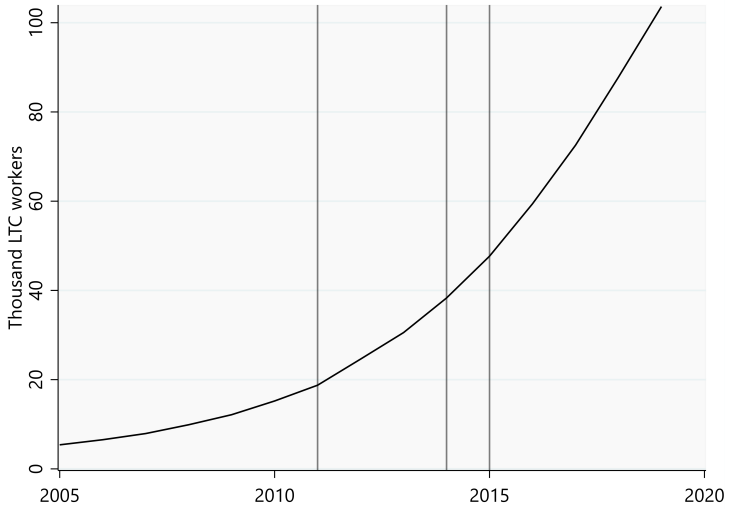

Figure 1: Evolution of foreign employment in LTC

Notes: Figure counts the yearly number of non-Germans who are LTC workers and have arrived in Germany in 2001 or later. For the LTC employment evolution of foreigners arriving up to 2000, see Figure A3.1. Based on own calculations using the main dataset described in Section 2.

In the context of the LTC sector, labor market openings were associated

[16] An exception was made for citizens of Cyprus and Malta, whereby they immediately gained restriction-free access to the German labor market upon the accession in 2004.

with a particularly strong increase in the number of foreign workers. While the mean year-on-year growth of the employable foreign population in Germany was 6.1% between 2011 and 2019,[17] the migrant stock in the LTC sector alone grew by 17.6% on average every year. Figure 1 shows the evolution of the stock of migrant workers taking up employment in LTC between 2005 and 2019. The vertical lines mark the three labor market openings toward the NMS. The figure confirms that the last two decades have seen a dramatic increase in the number of foreign LTC workers. Starting in 2005, about 5000 migrant workers were employed in the LTC sector in Germany. This implies a 1:100 ratio of migrant to native workers at that time. Over time, this stock has grown drastically, reaching over 100,000 migrant workers in 2019 and altering that same ratio to 1:10.

Table 1 confirms that the EU Enlargement significantly affected the number and the composition of the foreign LTC workforce, with the share of workers coming from the NMS increasing by over ten percentage points between 2010 and 2015. Other European countries, notably Ukraine and the non-EU countries comprising the former Yugoslavia (Serbia, Montenegro, and Kosovo), have been losing their importance over time, but they remain important sources of migrant LTC workers. We further see that the 2015 Refugee Crisis had a moderate impact on the origin composition of the care workers, growing strongly after 2015 and reaching close to 6% of the pool. Nonetheless, the gain in importance of the NMS after 2011, at the expense of other European origins, is the main source of variation in the stock of migrant care workers. Note that, even before the opening of labor market in 2011, a sizable fraction of foreign LTC workers came from the NMS.[18]

Overall, the descriptive evidence confirms that the LTC sector has seen a drastic increase in the number of foreign workers since 2005 in the last twenty years, with the steepest increases seen after the first labor market opening in 2011. This and the subsequent policy changes toward the NMS are the main

[17] Employable foreign population refers to the stock of foreigners residing in Germany and aged 15-65. Based on Destatis, 2023a.

[18] For instance in the case of Poland, the main sending country, this was possible through short-term, contract work or guest worker programs (Marks-Bielska et al., 2015).

Table 1: Foreign worker stock and its composition by country of origin group, selected years

	2005	2010	2015	2019
Percentage share in total stock				
New Member States	34.27	29.81	41.25	35.93
Other Europe	42.27	45.89	38.10	35.76
2015 Refugee Crisis	2.06	2.34	2.22	5.95
Africa	5.74	8.22	7.13	8.50
Americas	3.35	3.22	2.79	2.65
Asia Pacific	12.21	10.26	8.40	11.10
Total stock	5399	15225	47673	103621

Notes: The label "2015 Refugee Crisis" represents Syria, Afghanistan, Nigeria, Pakistan, Iraq and Eritrea. These countries are then excluded from the shares of their corresponding continents. Shares may not add up to 100% due to a small fraction of workers with unknown nationality or stateless. Sample includes only foreigners with plausible arrival date in 2001 or later. Based on own calculations using the main dataset described in Section 2.

drivers of the variation in the composition of the migrant LTC worker pool. At the same time, migrant workers have not settled evenly across the 401 German regions, generating a significant spatial variation. We document the regional variation in Appendix Figure B.2 and show how the increase in LTC workers during that period varies by regions. While we identify some regional clusters, there still remains remarkable variation between neighboring regions. We exploit both of these types of variation in our estimation strategy, outlined below.

4 Empirical strategy

In this section, we first present the specification for the regional analysis. We then describe the model used to estimate the effects of the inflow of migrants into the LTC sector on the careers of the insiders and the outsiders. Finally, we detail the construction of our proposed shift-share instruments, which allow us to interpret the results as causal effects, and validate its suitability through a number of tests.

4.1 Effects of migration into LTC sector on regional staffing

To investigate the regional effects of migration into the LTC sector, we estimate the following equation for the years 2005-2019:

$$\Delta y_{r,t} = \beta \Delta I_{r,t} + x'_{r,t-1}\alpha + \delta_t + \gamma_r + \theta_{s,t} + \epsilon_{r,t} \tag{1}$$

The outcome variable is the change in native staff-to-elderly ratio (number of native LTC workers scaled by 2005 elderly population) in region r between *t-1* and *t*. The main variable of interest is the change in the foreign staff-to-elderly ratio in region r between *t-1* and *t*. Additionally, we include $x'_{r,t-1}$ to control for time-varying characteristics of regions, which may proxy local trends in labor supply and demand. Since the LTC sector is female-dominated, we include the regional share of female inhabitants between age twenty and sixty, in bins of five years. Moreover, as employment in the sector is shown to be countercyclical (Stevens et al., 2015), we include lagged regional unemployment rates. To proxy regional demand for LTC workers, we include the lagged ratios of i) inpatient facilities, and ii) outpatient facilities, to elderly population, as well as the share of ambulatory care receivers among all care receivers. Finally, for the 401 regions, we include region-fixed effects (γ_r), as well as additional time effects (δ_t) and, in some specifications, state-by-year fixed effects ($\theta_{s,t}$). We cluster the errors on the level of the region r.

4.2 Effects of migration into LTC sector on native careers

To measure the individual career effects, we adapt the framework from Autor et al., 2013 and Autor et al., 2021 to estimate how the total inflow of migrants between 2010-2019 affects individual working careers.[19] As outlined in Section 2, we analyze the career effects separately for insiders and outsider depending

[19] We follow Dustmann et al., 2017 and measure the impact of the total shock, between 2010 and 2019, instead of focusing on yearly shocks.

on their employment status in 2010.[20] For each group g, we separately estimate consecutively longer first differences:

$$\Delta y_{g,r,t-h\to t} = \alpha_{g,t} + \beta \Delta I_{r,2010\to 2019} + x'_{g,r,t-h}\alpha + \mu_{g,r,t} \tag{2}$$

where $\Delta y_{g,r,t-h\to t}$ represents a given career change for a group g residing in region r, which we measure between t-h and t. We focus on several outcome variables to analyze the career effects, as outlined in Section 2. The main treatment variable is the change in foreign staff-to-elderly ratio in region r between 2010 and 2019. To control for the predetermined regional and group characteristics, we include mean age and labor market tenure as observed in 2010, as well as further regional controls, including female participation rate, female share in population, unemployment rate, and the local demand controls described in Section 4.1, all fixed to the year 2010.

4.3 The instrument

Both the native labor market outcomes and migrant inflows are likely to be correlated with unobserved characteristics of the local labor markets, yielding the OLS estimates of the above equations biased. To address this threat, we construct a leave-one-out version of the shift-share instrument (Bartik, 1991, Card, 2001) and apply it in a two stage least squares setting. In particular, we predict the change in the foreign LTC worker count as follows:

$$\Delta M_{r,t-h\to t} = \sum_c \frac{Migrants_{c,r,2000}}{Migrants_{c,2000}} \Delta \ Foreign\ LTC\ workers_{c,t-h\to t,-r} \tag{3}$$

where c corresponds to the origin country of a migrant moving into region r at time t.[21] We scale $\Delta M_{r,t-h\to t}$ by the number of elderly in the applicable base year (2005 or 2010), thus yielding the instrumented foreign staff-to-elderly ratio. Throughout the paper, we refer to this instrument as the baseline in-

[20] The results are qualitatively similar (available upon request), if we choose year 2005 as the baseline year for building the insider and outsider samples.

[21] There are 201 potential sending countries or regions in our dataset.

strument. In the main specification of the regional staffing analysis, we focus on inflows between two adjacent years ($h = 1$). For the career analysis, we use a cumulative measure of the inflow of foreign LTC workers and, as such, we focus on the difference between year 2010 and 2019 (i.e. $(t, h) = (2019, 9)\}$). Importantly, the final term in Eq. (3) represents the national-level net inflows of foreign *LTC* workers, as opposed to foreign workers more generally. We compare the results using differently focused instruments in Appendix C2.

We base our instrument on the so-called network hypothesis, i.e. the idea that foreign LTC workers tend to take up residence in areas where past co-national *migrants* have settled. In particular, to build the instrument, we set the historical share to reflect the regional composition of migrants as of year 2000; we include all foreigners who reside in a given region, irrespective of their employment status, age, and occupation. The chosen base year is well suited from the perspective of the main migrant wave we exploit: it is set to eleven years before the first labor market opening toward the first round of EU Expansion; not only that, it is also before the final EU entry referendums were held in these then-candidate countries. We use these historical shares to redistribute the yearly net inflows of workers originating from a given country c into the German LTC sector. In order to minimize the threat that any particular region is driving national-level inflows of LTC workers into Germany, we exclude the inflow to region r from the national inflow when calculating the change in the foreign LTC worker count in that region, $\Delta M_{r,t-h\to t}$.

Throughout the analysis, we leverage changes in the composition of immigrants coming from NMS as plausibly exogenous variation. In particular, as shown in Table 1, the EU labor market openings induce significant variation in the composition of migrants. To exploit the changes related to the EU labor market openings more directly, we propose an alternative instrument. This instrument allows a given country of origin to supply migrants only upon their respective labor market inclusion. In other words, we set the pre-opening flows to zero for the NMS when building the instrument, and leave the inflows from the remaining countries of origin unchanged. A similar strategy is used

in Tabellini, 2020.[22] We use this instrument to provide evidence that the baseline results are driven by the variation induced by the post-2010 labor market openings, as opposed to earlier foreign employment.

This instrument also proves valuable in addressing a potential issue arising from other policy changes prompted by the inclusion of the new member states into the EU. One such change involves the liberalization of self-employment, which happened directly upon the relevant EU enlargements (2004, 2007 and 2013) and led to an influx of self-employed migrants from the NMS (Kahanec and Zimmermann, 2010). However, our measures of foreign employment in LTC do not include self-employed workers, as they are typically not liable to social security and, thus, do not appear in the administrative data we employ (Jacobebbinghaus and Seth, 2007). Furthermore, directly upon accession, it was possible to enter and reside in Germany without any formalities, especially for shorter periods of time, which enabled to take up unregistered employment in domestic care (Lutz and Palenga-Möllenbeck, 2010).[23]

A potential concern is that effects on native employment and careers may be driven by self-employed or unregistered migrant workers, if their employment patterns are similar to those of the observed foreign workers. By exploiting the difference in the timing of market access through self-employment or unregistered work and the LMOs, we can test this scenario. If results using the LMO instrument differ from the baseline measure, this suggests a significant impact of pre-LMO foreign employment on our estimates and existence of a potential bias from immigrant self- or unregistered employment. To address this, in the analyses that follow, we present alternative results using the LMO instrument.

Relatedly, foreign employment in LTC could also operate through worker posting. The German government liberalized worker posting concurrently with

[22] In the context of migration to the US, Tabellini, 2020 proposes an instrument that allows immigration to the US solely from the ally countries between 1910-1920 and immigration only up to the quotas imposed by the subsequent Immigration Acts in 1920-1930.

[23] For the applicable law, see Directive 2004/38/EC. For up to three months, it was possible to enter and reside in Germany without any formalities. Past three months, registration was necessary. Without gainful (self-)employment, it was possible to reside upon proof of sufficient resources and health insurance coverage.

the introduction of the free movement of labor from the new member states in 2011 (Kahanec and Zimmermann, 2010, Muñoz, 2023). Within the context of LTC, worker posting likely plays a role in the provision of non-family informal care. Our measures of foreign employment in LTC do not include posted workers, as these typically pay social security in sending countries and, thus, do not appear in the German records (De Wispelaere et al., 2022). At the same time, Leiber et al., 2019 provide evidence that the posted worker location choices are also consistent with the network hypothesis. This implies that the observed effects may potentially reflect the joint impact of the two types of workers, such that crowding-out (-in) effects of formal foreign employment in LTC could potentially be smaller (larger). We return to this point when discussing the estimation results.

4.4 Validating the identification strategy

Before we turn to the discussion of the estimation results, we provide additional evidence about the validity of our identification strategy.

Exogeneity of initial shares

The literature on the usage of shift-share instruments proposes two broad approaches of defining what exogeneity means for the case of the instrument (see e.g. Goldsmith-Pinkham et al., 2020, Borusyak et al., 2022). We think of our set-up as the different migrant waves, most notably the labor market openings in 2011, 2014, and 2015, representing a set of common shocks, which penetrates German regions in a degree proportional to their historical composition of immigrants. As such, the validity of the proposed instrument is determined via the exogeneity of shares, as per Goldsmith-Pinkham et al., 2020.

To be precise, the exogeneity of shares in our case means that the past settlement patterns of migrants influence the labor market outcomes of native LTC workers solely by representing an incentive, or a pull factor, for contemporaneous, co-national migrants to settle in a given area. While a number of scenarios that could challenge this assumption is addressed by controlling for

level differences across the regions, we explore three possible channels that are not accounted for in such an approach.

The first potential channel involves the impact of past retirement trends on contemporary LTC outcomes. In particular, migrant enclaves up to the base year may have formed in areas with relatively more job vacancies due to a high number of exits into retirement. If higher proportions of retirees in the past translate into a higher contemporaneous demand for care, then the past settlement patterns may explain the contemporaneous labor market conditions in the LTC sector in a way unrelated to the contemporaneous migration and the network hypothesis.

A second, related, channel investigates the relationship between historical changes in old-age dependency rates and immigration. The historical migrants may have settled in areas that were undergoing stronger development in geriatric services, plausibly exhibiting a stronger growth in the old age dependency rate. If the geographical distribution of such employers persists across time, we may observe a direct relationship between historical settlement patterns and present LTC labor market outcomes beyond the effect of contemporaneous immigration.

Finally, given some degree of substitutability of formal and informal care (Bonsang, 2009), which is in general provided by women, we recognize that areas in which women are relatively over-represented among the unemployed may have a lower demand for formal LTC care. If this over-representation develops more dynamically in regions that are attractive for migrants, for instance because the local industry composition, we may again see a similarly spurious relation.

We test whether these channels can plausibly introduce endogeneity issues to our estimation strategy. Specifically, we check if, for each country of origin, we find a significant correlation between the migrant shares, $\frac{Migrants_{c,r,2000}}{Migrants_{c,2000}}$, and three proposed outcomes. First, we investigate the relationship between the historical migrant shares and the relative size of the local retirement exits. Absent data on the exact retiree count, we proxy the first indicator with

the 1995-1999 change in the share of population between ages 60 and 65.[24] Secondly, we focus on the 1995-1999 change in the old-age dependency ratio, defined as the ratio of inhabitants aged 65 or older to inhabitants between 15 and 65. For the third and final channel, we take the 1995-1999 change in the proportion of unemployed that are female. In each regression, we include the standard supply controls as in Equation (1).[25]

The results of these checks are depicted in Figure 2. Overall, the analysis clearly rejects systematic violations of exogeneity from these alternative channels. Across all panels, we find that the pre-2000 increases in the proposed regional characteristics are not significantly related to the migrant settlement patterns in 2000, for a vast majority of the origin countries. The four exceptions are Czech Republic, Italy, Slovakia, and Vietnam. As a robustness check, we supplement the baseline results with an alternative specification that excludes these four countries when calculating the realized and instrumented regional inflows of workers.

Selection into the insider and outsider samples

To ensure the validity of our analysis of the career effects, we conduct a test to confirm that the construction of the insider and outsider samples is not selected on pre-existing regional employment trends, which could coincide with future migration inflows. For instance, in regions with a high number of outsiders at the base year 2010, the job search may have taken longer due to a higher competition for suitable jobs. If these regions also receive a relatively high inflow of foreign LTC workers in the next years, the observed positive effect on outsider unemployment may be driven by initial selection, rather than migrant arrival. The career analysis thus relies on the assumption that the distribution of outsiders across regions is not selected on the (future) inflows of foreign LTC workers. A similar supposition is made in the case of insiders.

[24] For the cohorts retiring before 2000 in Germany, the standard retirement age was 60 for women and 65 for men (Börsch-Supan and Schnabel, 1999).

[25] We are unable to include the demand controls as these statistics start in 2003. We perform this check for all countries that constituted at least 1% of total inflows into Germany in at least one year between 2005 and 2019.

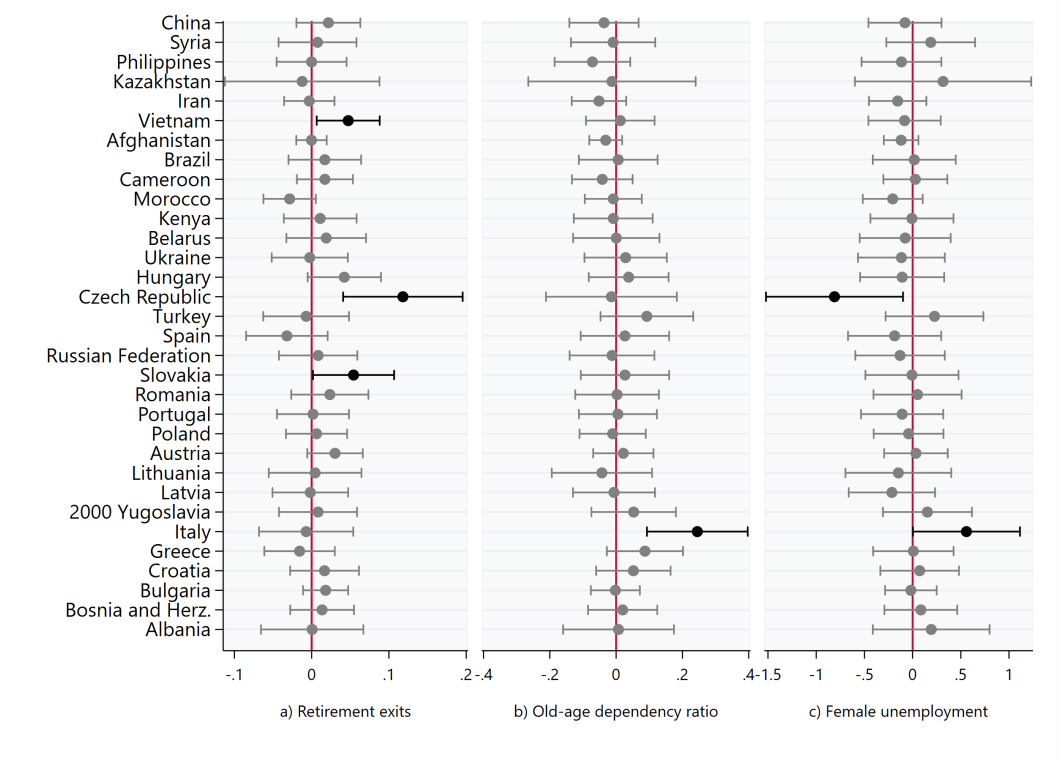

Figure 2: Conditional correlation between base migrant shares and 1995-1999 changes in retirement exit, old-age dependency ratio, and female unemployment proportion.

Notes: Figure plots coefficients of a regression of *a) regional 1995-1999 change in the share of population between 60-65 years old, b) 1995-1999 change in old-age dependency ratio, and c) 1995-1999 change in proportion of females among unemployed* on the base year (2000) regional shares of a given country of origin, controlling for the supply controls as presented in Section 4. Each (cross-sectional) model uses 401 observations, equivalent to the number of regions. "2000 Yugoslavia" is meant to jointly reflect Serbia, Montenegro, and Kosovo. Whiskers reflect 95% confidence intervals. The underlying data originates from the German Statistical Office (for more details, see Appendix A1).

To gauge the plausibility of this scenario, we propose the following test. For each region, we calculate the cumulative 2005-2010 percentage change in the size of the two groups of interest. We then regress these growth indicators on our total migration measure ($\Delta I_{r,2010\to2019}$) and the same set of regional controls we use in the career analysis. Table 2 presents the OLS and TSLS results using the baseline shift-share instrument. All estimated coefficients for the foreign staff-to-elderly ratio are small in magnitude and statistically not significant. Thus, we can reject that the outsider and insider groups evolved

Table 2: Effect of cumulative migrant shock 2011-2019 on pre-shock growth in insiders and outsiders

	(1)	(2)	(3)	(4)
	Insider		Outsider	
	OLS	TSLS	OLS	TSLS
Δ Foreign staff-to-elderly ratio	-0.002	0.006	-0.055	0.063
	(0.007)	(0.012)	(0.054)	(0.099)
First-stage coefficient		0.729***		0.729***
		(0.163)		(0.163)
K-P F-statistic		19.775		19.775
Observations	401	401	401	401

Notes: The table presents the coefficients from a OLS (Columns 1 and 3) and TSLS (Columns 2 and 4) regression of 2005-2010 growth in insider (resp. outsider) sample on the cumulative change in (instrumented) foreign staff-to-elderly ratio between 2010 and 2019. The underlying instrument is the baseline instrument. All columns include the regional controls. Robust standard errors shown in the brackets. *** p<0.01, **p<0.05, *p<0.1.

differently in high- versus low-inflow regions prior to 2010.

5 Results

We begin this section by providing the first-stage results of a two-stage-least-squares estimation using a broad range of Bartik-style instruments. Having ensured consistency across these specifications, we move on to quantifying the exogenous impact of foreign LTC staffing on native regional employment and on individual worker careers.

5.1 First-stage results

Table 3 provides the results of the first-stage estimation, jointly for the regional staffing analysis (Panel A) and the native careers analysis (Panel B).

In Panel A, across all columns, we include demand and supply controls, as well as region- and time-fixed effects. Column 1 provides the baseline estimate and implies that an increase of a hundred foreign workers as predicted by the shift-share corresponds to a realized additional inflow of foreign workers of about fifty-three. This result also holds if we forgo using the leave-one-out method when building the instrument, as depicted in Column 2. In both cases,

Table 3: First-stage results

	(1) Baseline	(2) Simple Flow	(3) LMO Instrument	(4) Excl. CZ, IT, SK, VN
Panel A: Regional staffing analysis				
First stage coefficient	0.525***	0.526***	0.502***	0.540***
	(0.112)	(0.110)	(0.106)	(0.110)
K-P F-statistic	21.991	22.861	22.364	24.119
Observations	5614	5614	5614	5614
Panel B: Insider and outsider analysis				
First stage coefficient	0.737***	0.658***	0.690***	0.730***
	(0.169)	(0.155)	(0.166)	(0.163)
K-P F-statistic	18.159	17.053	16.498	19.345
Observations	401	401	401	401

Notes: For both panels, Column 1 shows the first-stage result using the baseline instrument. Column 2 uses full national inflows to build the instrument, i.e. discards the leave-one-out method. Column 3 uses our alternative instrument exploiting labor market openings. Column 4 estimates the first-stage by excluding Czech Republic, Italy, Slovakia and Vietnam from both the instrumented and the realized inflow of foreign LTC workers. For Panel A, all columns feature supply and demand controls, as well as region- and time-fixed-effects, mirroring the preferred specification in Column 4 of Table 4. The standard errors are clustered on the region level. For Panel B, all columns feature the regional and group controls as noted in Section 4.2, and the standard errors are robust. Standard errors are shown in the brackets.*** p<0.01, **p<0.05, *p<0.1.

the instrument is fairly strong, with an F-statistic above 20. Column 3 presents first-stage results using an LMO instrument, which exploits the variation generated by the EU expansion directly. We interpret the proximity of the results of the baseline and LOM specifications as evidence that the different steps of the EU-Enlargement provide the key variation of the identification. Moreover, the similarity of the coefficient to the main specification speaks against the gain in the access to the market in 2004 via self-employment and informal care driving our baseline results (see Section 4.3). Finally, Column 4 depicts the first-stage results wherein Czech Republic, Italy, Slovakia, and Vietnam are excluded. The similarity to the baseline coefficients speaks against these countries introducing bias into the proposed instrument.

The first-stage results in the native careers analysis, as depicted in Panel B, are broadly in line with those of Panel A, despite a different estimation

specification and time horizon used. Given the time invariant nature of the migration shock, the first stage results are equivalent across all time horizons (i.e. for any $t-h \rightarrow t$ in $y_{t-h \rightarrow t}$ of Eq. (2)). The first stage coefficients are generally higher than in Panel A and feature a slightly lower F-statistic. However, the preferred coefficient of 0.525 from Panel A is included in the 95% confidence interval in all four cases. Moreover, between the different methods, the point estimates are again similar and are not significantly different from each other at the 5% level.

It is important to note that our baseline instrumental variable exhibits a low level of serial correlation. As discussed in Jaeger et al., 2018, the shift-share exogeneity is unlikely in settings where the national inflows feature a stable country-of-origin mix, which introduces serial correlation in immigrant inflows. In our setting, such serial correlation would imply that the baseline estimation conflates the labor market responses to more recent versus lagged immigration into the LTC. This issue is unlikely given the variation in the origin of the migrant LTC pool as shown in Table 1; nonetheless, we confirm that the period of study is indeed characterized by sufficient compositional changes, by adapting the empirical test proposed by the Jaeger et al., 2018. Due to the uncommonly high frequency of our yearly data[26], longer time lags may be necessary to isolate the unfinished, longer-term labor market adjustments from the contemporaneous changes. As such, we introduce consecutive lagged inflows of order k (and their corresponding instruments) into the baseline Eq. (1).[27]

To this end, Table B.2 shows the first-stage results of including lags up to the fourth order. Unsurprisingly, due to high year-on-year correlation, we find that the lagged instrumented inflow is predictive of the contemporaneous realized inflow for the case of one- and two-year lags. For lags of the order of three or more, contemporaneous inflows of migrant LTC workers are solely

[26] In general, comparable studies are based on census data with a frequency of 5 or 10 years, see e.g. Jaeger et al., 2018.

[27] To be specific, the full model is as follows: $\Delta y_{r,t} = \beta_1 \Delta I_{r,t} + \beta_2 \Delta I_{r,t-k} + x'_{r,t-1}\alpha + \delta_t + \gamma_r + \theta_{s,t} + \epsilon_{r,t}$, for k = {1,2,3,4}. To investigate the serial correlation issue, we focus on the first stage of the above estimation.

correlated with their contemporaneous instruments; the opposite is true for lagged inflows. While these results make it unlikely that our baseline conflates the effect of older versus more recent inflows of immigrants into the LTC over medium to longer-term time horizons, we put this hypothesis to test directly in the next section, where we re-estimate the regional staffing analysis using a modified dataset with a three-year frequency.

5.2 Effect of immigration on regional LTC staffing

Given the plausible exogeneity of the proposed instrument, we move on to discussing the central results. Table 4 presents the results of the regional analysis, wherein the outcome of interest is the local change in native staff-to-elderly ratio. First, while the OLS (Panel A) specifications suggest that migration causes a crowding-in of natives, the IV (Panel B) estimation suggests that migration into the sector leads to a small displacement of native workers away from the long term care occupation. The stark difference between the two panels reveals that the OLS results are confounded by unobservable positive demand shocks, which is consistent with the German regions experiencing differential growth rates of care need as well as differences in economic circumstances.

According to the specification presented in Eq. (1), a coefficient of minus one implies a complete substitution between migrant and native LTC workers, such that, *ceteris paribus*, the overall supply of care workers in a region remains the same. Conversely, our preferred specification in Column 2, which includes an extensive list of controls of local labor demand and supply in the sector, with a coefficient of about -0.46 suggests a partial displacement - ten foreign nurses displace four to five native nurses. Reassuringly, this result holds also when including state-by-year fixed effects in Column 3, although the first stage is notably weaker. We find similar displacement when foregoing the leave-one-out method in shift-share construction (Column 4), using the labor market opening instrument (Column 5), and when we exclude the potentially problematic countries flagged in Section 4.4 entirely (Column 6). Furthermore, using a three year panel (Column 7) to address the serial cor-

Table 4: Effect of LTC immigration on change in regional native staff-to-elderly ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: OLS								
Δ Foreign staff-to-elderly ratio	0.136**	0.247***	0.294***	0.247***	0.247 ***	0.245***	-0.045	0.380***
	(0.069)	(0.073)	(0.079)	(0.073)	(0.073)	(0.076)	(0.099)	(0.089)
Panel B: IV								
Δ Foreign staff-to-elderly ratio	-0.453***	-0.464**	-0.416*	-0.453**	-0.475 **	-0.452**	-0.572**	-0.604
	(0.148)	(0.208)	(0.248)	(0.203)	(0.209)	(0.204)	(0.284)	(0.504)
First stage coefficient	0.674***	0.525***	0.465***	0.526***	0.502***	0.540***	0.513***	0.312***
	(0.099)	(0.112)	(0.125)	(0.110)	(0.106)	(0.110)	(0.129)	(0.097)
K-P F-statistic	46.659	21.991	13.755	22.861	22.364	24.119	15.702	10.352
Observations	5614	5614	5586	5614	5614	5614	1604	3609
Regional fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Controls		✓	✓	✓	✓	✓	✓	✓
State-by-year fixed effects			✓					
Simple instrument				✓				
LMO instrument					✓			
Excl. CZ, IT, SK, VN						✓		
Panel frequency (years)	1	1	1	1	1	1	3	1
First panel year	2005	2005	2005	2005	2005	2005	2005	2011

Notes: Panel A estimates Eq. 1 using OLS. Panel B estimates Eq. 1 using TSLS and the baseline instrument, unless otherwise noted. *Simple instrument* refers to the an instrument built without the leave-one-out method. *LMO instrument* refers to the alternative instrument exploiting labor market openings. *Excl. CZ, IT, SK, VN* refers to an alternative instrumented and realized change foreign staff-to-elderly ratio which excludes a number of countries flagged in Section 4.4. Standard errors are clustered on the region level and shown in the brackets. Controls include both supply and demand controls. *** p<0.01, **p<0.05, *p<0.1.

relation concerns of the previous section leads to a somewhat higher point estimate, but not statistically different at 5%, of almost six natives for each ten foreign workers over a three-year period. Finally, in Column 8, we follow our preferred specification but only use years 2011-2019, which is the time period used for the career analyses. The point coefficient remains similar to the baseline estimate, but the standard errors increase by restricting the number of observations; this also results in a low F-statistic for this specification. Summarizing, across all specifications, we find a partial displacement effect that implies an increases in the overall staffing numbers due to the immigration into LTC, thereby reducing worker shortages.

Referring back to Section 4.3, the estimated coefficient may potentially be a combined effect of labor market openings and worker posting liberalization, which occurred at the same point in time in the year 2011. Given the

hypothesized positive correlation in settling patterns between posted versus locally employed workers, controlling for worker posting would decrease (in absolute terms) the estimated effect of foreign staffing, nonetheless leading to the conclusion of migration reducing labor scarcity.

In the subsequent section, we extend our analysis beyond the impact of foreign worker influx on local employment in the LTC sector. Leveraging comprehensive individual social security records, we move on to investigate the effects of immigration on the career trajectories of native LTC workers. We quantify the impact of local immigration on individual employment outcomes, which encompasses changes in occupation, experiencing unemployment, as well as wage progression and changes in job characteristics. Importantly, in doing so, we distinguish between the two groups of interest: the insiders and outsiders.

5.3 Effect of immigration on careers of insiders

We proceed by characterizing the displacement effects of increases in foreign LTC staffing. Overall, we document that the vast majority of insiders who leave the LTC sector due to inflow of foreign LTC workers move on to hold different occupations, as opposed to moving into unemployment. Higher immigrant inflows lead to job transitions into occupations that place lower psychological and physical demands on workers, involve a task change, and earn higher wages. In the section below, we discuss these findings in detail.

Tables 5 and 6 quantify these results over shorter and longer time horizons, in particular for the years 2011, 2015, and 2019.[28] For each outcome of interest, we report the coefficient and standard error of a specification with the full set of regional and group controls (see Section 4.2), as well as the relative effect with respect to the mean of the given year. As noted in Section 2, all outcomes (except for the change in wages) represent the share of 2010 LTC workers who are observed to have a particular employment outcome in a given year. For wages the outcome is defined as the difference in log wage between a given

[28]For years and outcomes not shown in the main tables, see Table B.3. We also report the average yearly inflows of foreign LTC workers in Table B.4.

period and the base period, 2010. Each coefficient represents the effect of a time-invariant, cumulative migration shock, measured between 2010 and 2019.

Impact on native career transitions

We begin by analyzing the effect of LTC migration on the likelihood of employment as a care worker versus taking up employment outside of the sector, becoming unemployed, or undergoing another transition that combines transition into self-employment, transition to the civil service, non-employment, retirement or death.

The results are presented in Table 5. In a manner similar to the regional staffing analysis, we first confirm that inflows of foreign LTC workers cause an increase in the exit rate of insiders from the LTC occupation. We find consistently negative effects of immigration on the share of insiders working in LTC; the coefficients vary between 1.6 to 2.3 percentage points. By 2011, our results suggest that one more foreign LTC worker per hundred elderly decreases the share of the insiders that are still employed in LTC by 1.6 percentage points. By 2019, increasing the inflow by the same relative amount causes a 1.9 percentage points reduction in the share. These results suggest that the displacement is compounding over time, also in relative terms with respect to the corresponding mean shares (1.9% between 2010-2011 versus 3.9% between 2010-2019). For the insiders, exiting the care work occupation predominantly leads to transitions into occupations outside of LTC sector. Depending on the time horizon considered, the average inflow of foreign workers implies an increase of between 1.1 percentage points and 1.7 percentage points in non-LTC employment. We also find a positive, but smaller, effect on the insider probability of unemployment, at 0.3 to 0.5 percentage points. The corresponding relative effects are high, given the low average unemployment rate of insiders, between 2.5% and 3.8%. Finally, as depicted in Column 4, we do not find a significant relationship between higher migrant inflows and other transitions.

Although we cannot distinguish between employee- and employer-driven transitions, it is reasonable to assume that at least some of the observed job changes are voluntary. As such, it is important to consider the reasons why

the natives choose to switch occupations in response to immigration. Previous literature suggests at least two potential mechanisms. First, the quality of the working environment, as perceived by the native workers, could decrease in response to migration, for instance because the foreign workers do not speak the native language sufficiently well (Cortés and Pan, 2014). Secondly, immigration into LTC may cause a change in wage structure in the LTC occupation relative to other occupations, making the switch more attractive than before (Ortega and Verdugo, 2022).

Table 5: Effect of increase in foreign staffing on native career transitions of insiders, selected years

	(1) Still in LTC	(2) Job not in LTC	(3) Unemployed	(4) Other transition
2011	-1.557***	1.081***	0.259***	0.216
	(0.335)	(0.290)	(0.090)	(0.154)
	[-1.932%]	[11.174%]	[10.065%]	[3.008%]
2015	-2.289***	1.713***	0.541***	0.035
	(0.470)	(0.395)	(0.129)	(0.235)
	[-3.838%]	[7.995%]	[15.194%]	[0.230%]
2019	-1.895***	1.300***	0.463***	0.132
	(0.420)	(0.348)	(0.141)	(0.248)
	[-3.947%]	[5.090%]	[16.283%]	[0.559%]

Notes: The table presents the effect of change in foreign staff-to-elderly ratio, measured between a given year and 2010, on a 2010-2019 change in a given outcome, estimated using TSLS and the baseline instrument. All estimated models include regional and group controls described in Section 4.2 and are based on 401 observations. For the average changes in foreign staffing compared to 2010, see Table B.4. For years not shown, see Table B.3. Robust standard errors are shown in brackets. Coefficient sizes relative to the mean are shown in square brackets. *** p<0.01, **p<0.05, *p<0.1.

Impact on native job characteristics

The evidence thus far suggests that increases in foreign LTC staffing have a partial displacement effect on the native LTC workers, with many shifting to non-LTC occupations. As such, we move on to investigate the impact of

migration into LTC on the nature of jobs held by the native workers. First, Columns 1 and 2 in Table 6 quantify the impact of local immigration into LTC on the degree of job demand, as compared to the strain posed by the care work. Overall, the results suggest that higher migrant inflows induce the insiders to change to jobs that feature less physical and psychological strain. In terms of physical improvements, an average increase in foreign LTC staffing increases the share of workers with better jobs by 0.6 percentage points up to 1.0 percentage point (10.4% up to 13.8% with respect to the means). Similarly, an average increase in foreign LTC staffing leads to 0.6 up to 0.8 percentage points improvement (8.1% to 12.4%) in the share of insiders with less psychologically demanding jobs than before.

We further find LTC migration to have a consistently positive effect on insider transitions to jobs that feature changes in the nature of the main task performed. An average increase in foreign LTC staffing leads to a 0.2 to 0.4 percentage points (20.8% to 30.0%) increase in the share of workers performing analytical, non-routine main tasks (e.g. office administration, Column 3), as well as a 0.3 to 0.6 percentage points (17.5% to 26.5%) increase in the proportion performing cognitive routine main tasks (e.g. cashiers, Column 4). Finally, we observe a positive effect on wages, of up to 0.04 log points. Importantly, this estimate represents a combined effect on wages for the insiders who remain in the LTC sector as well as for those who shift to other occupations. Thus, it captures the overall effect of foreign LTC staffing on the insiders' earnings regardless of their occupation, rather than measuring the effect of migration on average wages in the LTC sector.

Heterogeneity

Our data allow us to also estimate heterogeneous career effects for relevant groups. Workers are characterized by care type - outpatient or inpatient - as well as by specialization - nurses, nursing assistants, or social (care) workers.[29] The worker counts and relative proportions of each type of worker in the

[29] Unfortunately, our data only allows us to confidently define the degree of specialization for 45.9% of the worker sample; we classify the remainder as general social/care workers.

Table 6: Effect of increase in foreign staffing on job characteristics of insiders, selected years

	(1) Physical strain	(2) Psychological strain	(3) Analytical, non-routine	(4) Cognitive, routine	(5) Δ log wage (vs 2005)
2011	-0.641***	-0.603***	0.203***	0.287***	0.013***
	(0.223)	(0.228)	(0.071)	(0.065)	(0.005)
	[13.840%]	[12.367%]	[29.364%]	[31.461%]	[14.837%]
2015	-0.964***	-0.814***	0.424***	0.603***	0.027***
	(0.270)	(0.257)	(0.090)	(0.113)	(0.008)
	[12.521%]	[9.785%]	[30.013%]	[26.494%]	[9.828%]
2019	-0.933***	-0.787***	0.390***	0.555***	0.040***
	(0.271)	(0.239)	(0.122)	(0.134)	(0.011)
	[10.382%]	[8.081%]	[20.753%]	[17.485%]	[9.329%]

Notes: See the notes under Table 5.

sample are presented in Table B.5.

Overall, we find that workers in outpatient services and higher-level nurses are the greatest beneficiaries following the increase in staffing, whereas the nursing assistants are the most disadvantaged. In the following we discuss the heterogeneity results in more. Table 7 quantifies the cumulative effect of local immigration into LTC on the insider career transitions across the proposed heterogeneity dimensions between 2010-2019. Firstly, we observe that the negative relationship between foreign staffing and native LTC employment is present for all heterogeneity groups and significant for inpatient workers, outpatient workers, and social workers. Nurses are slightly more likely to take up non-LTC employment, whereas the assistants are more likely to become unemployed. Finally, we document that the inflow of foreign LTC workers causes stronger displacement in the outpatient care sector. In particular, the transitions into other occupations happen predominantly for workers employed in the outpatient service; we find no evidence of the effect of migration into LTC on such transitions for the inpatient workers. Similarly to the baseline analysis, we do not find any effect of migrant inflows on the sample drop-out.

Furthermore, we also investigate the heterogeneous effects of migration into

Table 7: Effect of an increase in foreign staffing on insider career transitions across heterogeneity groups

(1) Baseline	(2) Outpatient	(3) Inpatient	(4) Nurse	(5) Assistant	(6) Social/ care worker
Share of insiders:					
- still providing care					
-1.895***	-3.100***	-1.289***	-1.007	-1.097	-2.282***
(0.420)	(0.666)	(0.472)	(0.867)	(0.701)	(0.530)
[-3.947%]	[-6.799%]	[-2.625%]	[-2.073%]	[-2.438%]	[-4.646%]
- with job out of LTC					
1.300***	2.682***	0.655	1.580**	0.360	1.464***
(0.348)	(0.649)	(0.453)	(0.670)	(0.614)	(0.483)
[5.090%]	[9.341%]	[2.705%]	[5.833%]	[1.431%]	[5.855%]
- in unemployment					
0.463***	0.471***	0.422**	-0.042	0.662***	0.499***
(0.141)	(0.134)	(0.176)	(0.147)	(0.185)	(0.190)
[16.283%]	[17.968%]	[14.384%]	[-2.084%]	[20.461%]	[16.565%]
- with another transition					
0.132	-0.052	0.212	-0.531	0.074	0.319
(0.248)	(0.445)	(0.255)	(0.528)	(0.435)	(0.316)
[0.559%]	[-0.225%]	[0.892%]	[-2.382%]	[0.280%]	[1.395%]

Notes: The table presents the effect of 2010-2019 change in foreign staff-to-elderly ratio on a 2010-2019 change in a given outcome, estimated using TSLS and the baseline instrument. All estimated models include regional and group controls described in Section 4.2 and are based on 401 observations. Results over short-term are available upon request. Robust standard errors are shown in brackets. *** p<0.01, **p<0.05, *p<0.1.

LTC on insider job characteristics, as shown in Table 8. Notably, all groups of workers experience a significant improvement in physical and psychological strain, with the exception of the inpatient care workers and assistants. Noteworthy are the pronounced effects for workers engaged in outpatient care - an addition of one more foreign LTC worker per 100 elderly increases the share of workers who see improvements in physical strain at work by 2.3 percentage points, or almost 20% of the mean share. We find a similar impact on psychological strain at work for this group, at 2.0 percentage points or 16.5% of the respective mean. We then check if the relationship between immigra-

Table 8: Effect of an increase in foreign staffing on insider job characteristics across heterogeneity groups

(1) Baseline	(2) Outpatient	(3) Inpatient	(4) Nurse	(5) Assistant	(6) Social/ care worker
Share of workers in jobs featuring:					
- higher physical strain					
-0.933***	-2.258***	-0.216	-1.486***	-1.113*	-0.410***
(0.271)	(0.582)	(0.236)	(0.390)	(0.610)	(0.119)
[10.382%]	[19.662%]	[2.719%]	[8.783%]	[6.163%]	[22.081%]
- higher psychological strain					
-0.787***	-1.955***	-0.155	-1.237***	-0.887	-0.319***
(0.239)	(0.570)	(0.229)	(0.396)	(0.611)	(0.100)
[8.081%]	[16.482%]	[1.754%]	[7.204%]	[4.396%]	[14.356%]
- analytical non-routine main task					
0.390***	0.326*	0.419***	0.263*	0.417**	0.398**
(0.122)	(0.181)	(0.122)	(0.139)	(0.165)	(0.159)
[20.753%]	[15.896%]	[23.284%]	[14.872%]	[25.121%]	[19.854%]
- cognitive routine main task					
0.555***	0.729***	0.431***	0.511***	0.786***	0.437***
(0.134)	(0.208)	(0.118)	(0.183)	(0.255)	(0.139)
[17.485%]	[16.995%]	[15.836%]	[15.411%]	[22.491%]	[14.630%]
- difference in log wage (vs 2010)					
0.040***	0.054***	0.029***	0.025	0.055**	0.035***
(0.011)	(0.018)	(0.010)	(0.016)	(0.024)	(0.011)
[9.329%]	[9.764%]	[7.667%]	[5.679%]	[12.517%]	[8.349%]

Notes: See notes of Table 7.

tion intensity and task types, as observed in the baseline, is driven by specific heterogeneity groups. The migration effects on switching tasks performed at work are discernible across all heterogeneous groups. Comparing the two task types within heterogeneity groups, we observe that the higher-skilled nurses are more likely to switch to analytical non-routine jobs, whereas the lower-skilled nursing assistants are more likely to move to jobs featuring routine, cognitive tasks. We see no clear differences in task transitions within the care type.

Lastly, we examine the heterogeneity in the impact on the differences in log wages. Notably, over extended time periods, the migrant influx leads to the most substantial wage gains for nursing assistants and outpatient services workers. The assistants have the lowest wages in the LTC sector (see Section 3).

5.4 Effect of immigration on careers of outsiders

In the final part, we discuss how the arrival of foreign labor into the LTC sector affects the careers of the outsiders.

Impact on native career transitions

We begin by investigating the effect of migration into LTC on the career transitions of the outsiders. The results are presented in Table 9. Overall, we find that increases in foreign LTC staffing lead to worse career outcomes for the outsiders by decreasing their employment in LTC and increasing unemployment. Over the short time horizon, we find that one more foreign LTC worker per 100 elderly decreases the outsiders' re-employment probability in the LTC sector by 1.7 percentage points. Furthermore, we also find that one additional foreign worker increases the share of outsiders who continue to be unemployed by 3.8 percentage points. These effects appear to be persistent as, by 2019, with effects of -1.4 percentage points for a transitions into LTC and +1.9 percentage points for remaining unemployed. Importantly, we find no effect of foreign LTC staffing on the outsider's take-up of employment in non-LTC sectors. In contrast to the insider sample, we find that the outsiders are less likely to drop out of the sample with stronger increases in foreign LTC staffing.

Heterogeneity

Next, we investigate whether the effect of the increase in foreign LTC staffing varies by the outsider's past work experience. In particular, we split the outsider sample by the number of years since the last LTC job, as of 2010, as well

Table 9: Effect of increase in foreign staffing on outsider career transitions, selected years

	(1) Back to LTC	(2) Job not in LTC	(3) Still unemployed	(4) Other transition
2011	-1.682**	0.236	4.230***	-2.783***
	(0.706)	(0.679)	(1.477)	(0.934)
	[-12.260%]	[1.121%]	[9.851%]	[-12.498%]
2015	-1.659**	-0.621	3.939***	-1.660**
	(0.767)	(0.910)	(1.128)	(0.761)
	[-9.303%]	[-2.078%]	[19.557%]	[-5.162%]
2019	-1.211*	0.408	3.122***	-2.319***
	(0.705)	(0.736)	(0.901)	(0.713)
	[-7.073%]	[1.285%]	[24.271%]	[-6.057%]

Notes: The table presents the effect of change in foreign staff-to-elderly ratio, measured between a given year and 2010, on a 2010-2019 change in a given outcome, estimated using TSLS and the baseline instrument. All estimated models include regional and group controls described in Section 4.2 and are based on 401 observations. For the average changes in foreign staffing compared to 2010, see Table B.4. For years not shown, see Table B.6. Robust standard errors are shown in brackets. Coefficient sizes relative to the mean are shown in square brackets. *** p<0.01, **p<0.05, *p<0.1.

as by the number of years in unemployment. The more recent (LTC) work episode is defined as at most two years since last (LTC) employment. For the relative group sizes, see Table B.7.

We present the results in Table 10. First, we find that stronger increase in foreign LTC staffing increases unemployment across all heterogeneity groups. Similarly to the baseline results, foreign staffing has no effect on the share of outsiders gaining employment outside of the LTC for either heterogeneity dimension. Importantly, we find that the arrival of foreign LTC workers decreases the potential to be reemployed in the LTC sector for those who are recently unemployed. In other words, the foreign staffing has the most adverse effects for a group of outsiders who are relatively more attached to the labor market in general and to the LTC sector in particular.

Table 10: Effect of an increase in foreign staffing on outsider career transitions across heterogeneity groups

(1)	(2)	(3)	(4)	(5)
Baseline	1-2 years	3+ years	1-2 years	3+ years
	since last LTC job		in unemployment	
Share of outsiders:				
- back to providing care				
-1.211*	-1.948**	-0.383	-1.580**	-0.153
(0.705)	(0.794)	(0.975)	(0.788)	(1.021)
[-7.073%]	[-10.039%]	[-2.796%]	[-8.589%]	[-1.129%]
- with job out of LTC				
0.408	1.220	-1.144	1.088	-1.775
(0.736)	(1.048)	(1.092)	(0.980)	(1.399)
[1.285%]	[3.925%]	[-3.473%]	[3.280%]	[-6.339%]
- in unemployment				
3.122***	3.551***	2.571***	3.482***	2.078*
(0.901)	(1.131)	(0.974)	(1.072)	(1.096)
[24.271%]	[30.846%]	[17.397%]	[29.736%]	[13.036%]
- with another transition				
-2.319***	-2.822***	-1.044	-2.989***	-0.151
(0.713)	(1.002)	(1.236)	(0.894)	(1.627)
[-6.057%]	[-7.428%]	[-2.706%]	[-8.140%]	[-0.354%]

Notes: See the notes under Table 7.

6 Conclusion

The rapid population aging across OECD countries has sizable implications for the demand and provision of LTC. A popular strategy to address the present and future worker shortages in this sector is to increase the inflow of working migrants. In this paper, we evaluate the effectiveness of this solution. To estimate the causal effect of immigration into the sector, we exploit a shift-share instrument, coupled with exogenous variation induced by labor market openings toward newly admitted EU states. We perform a variety of checks and probe the validity of the proposed instrument, addressing the concerns raised in the recent literature on the shift-share design.

Starting with a regional analysis, our results suggest that the inflow of

working migrants increases the overall staffing in the sector. In particular, we find that ten extra foreign workers displace about four to five native counterparts, which in turn implies that migration alleviates worker shortages in LTC.

Our main contribution lies in analyzing the impact of migration on native careers by comparing changes to the insiders versus outsiders of the LTC sector. We find vastly divergent impact of migration on the two groups. For insiders, we document that foreign LTC staffing causes displacement of the natives into other occupations, which feature better working conditions and increases their earnings. For outsiders, we show that the arrival of workers decreases their chances to become re-employed in the sector and prolongs their unemployment spell altogether.

These results underscore the need for future migration reforms to consider the distinct impacts on various labor market groups. A strategy combining an open-doors migration policy with reforms aimed at the mobilization of the unemployed could effectively tackle LTC sector shortages while enhancing career prospects for native workers, both unemployed and employed alike.

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Appendix

This Appendix is organized into three sections. Section A provides more details on the data construction, including detailing the auxiliary data sources, the method used to impute occupational codes, and the assignment of migrant worker status in the data. Section B includes additional tables and figures we refer to in the main text. Finally, Section C provides additional robustness checks.

A Further details on data construction

A1 Additional data sources

In addition to the social security data, we use four auxiliary data sources. First, we include the long-term care statistics (*Pflegestatistik*), which we link on the level of a region-year for years 2005-2019. This data is based on a bi-yearly survey covering the universe of German care facilities. The survey carries an obligation to participate, implying that the statistics bear close to no measurement error. Given its biannual frequency, we linearly interpolate values for the missing years. The long-term care statistics allow us to control for the number of facilities by the type of the care provided (outpatient versus inpatient) and to observe the stocks of patients who are cared for in said facilities.

Second, we use the General Index for Job Demands in Occupations (Kroll, 2011) and link it via occupational codes to the social security records. The time-invariant index features two components: physical burden, reflecting the frequency of carrying heavy loads, bending etc., as well as psychological burden, measuring, among others, the pace of work or the possibility of significant consequences arising from small mistakes. Each component is set on a scale of 0 to 10, with higher values indicating a more severe level of strain. We use these two components of the index to gauge if immigration-driven changes in jobs alter the physical and psychological burden of the natives.[30]

[30] Giuntella et al., 2019 use the same index and find that immigration decreases average

Third, we use the occupational codes to further merge the task operationalization database by Dengler et al., 2014. For each occupational code, the authors assign the main type of task performed by distinguishing between five possibilities: analytical non-routine, interactive non-routine, cognitive routine, manual routine, and manual non-routine (typical task for LTC worker). Like the Kroll index, the task decomposition data allows us to comment on the nature of the possible native job-to-job transitions associated with the immigration into LTC.

Finally, we also employ regional indicators accessible via the German Statistical Office (Destatis). These include: i) regional-level stocks of foreign residents, used in the construction of the shift-share instrument; ii) demographic information, such as the age structure by gender or elderly population size and old dependency ratio; and iii) regional unemployment statistics, including the overall unemployment rate as well as the proportion of unemployed who are female.

A2 Occupational code imputation

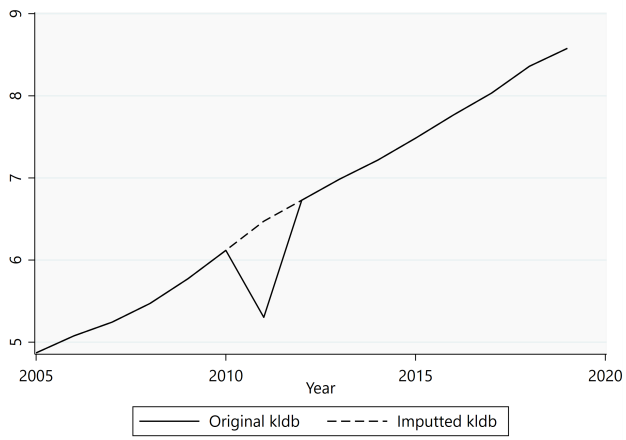
The main employment data source for the project relies on the notifications (reports) sent by employers to the social security administration. Among other details, these reports include the a 3 or 5-digit (depending on year) occupational code, which we rely on, in addition to the employer industry, to identify LTC workers in the data.

The German Classification of Occupations (KldB) was updated in 2010. In the transition period between the old and new classifications, the employers were, in principle, allowed to not report any occupational code between January 2011 and May 2012. This leads to a significant increase in the number of missing values in the grand data collected by the social security administration. This issue is apparent also in the case of our dataset. As shown in Figure A2.1, the transition period leads to a significant decrease in the national stock of LTC workers, followed by a sudden hike, once the transition period has

physical burden of native workers in England and Wales with medium or high levels of education; they find no effect on the psychological strain of natives.

ended.

Figure A2.1: Original versus imputed stock of LTC workers in Germany



Notes: The figure counts the number of LTC workers (both foreign and native), according to the original KldB classification (in black). It then superimposes the number of LTC workers are per the imputed KldB classification (grey line).

To alleviate this problem, we propose a simple imputation method. We impute the missing value with its first non-missing lag (or lead) if: 1) the missing occupational code is associated with an employment episode (i.e. the report comes from the *BeH* source, as opposed to other sources like the unemployment agency report); 2) the source occupational code is associated with an employment episode; and 3) both episodes are associated with the same employer. We first attempt to fill the gaps with past information, i.e. reports from 2010 or earlier. Having performed the first round of imputation, we then use the same rule but looking to fill the gaps from later years, i.e. reports from 2012 or later. Fig A2.1 shows the results of this imputation on the count of LTC workers in Germany.

While the proposed imputation method is rather straightforward, it is undoubtedly subjective and, therefore, may raise concerns that our results are driven by the imputation. To alleviate such concerns, we provide alternative results, this time excluding years 2010, 2011, and 2012 entirely. Notably, the imputation affects these years only, leaving the remaining observations in their

original form. Table A2.1 compares the baseline results of the impact of the changes in foreign staffing on native staffing and average wages, versus the equivalent specification but excluding the imputed years. Reassuringly, we see very little change in the coefficients. We interpret the results are evidence against the imputation playing a role in driving the results.

Table A2.1: Effect of LTC immigration on native staff-to-eldely ratio, excl. years 2010-2012

	(1)	(2)
	Baseline	Excl. '10-'12
Δ Foreign staff-to-elderly ratio	-0.464**	-0.346*
	(0.208)	(0.179)
First-stage coefficient	0.525***	0.513***
	(0.112)	(0.113)
K-P F-statistic	21.991	20.718
Observations	5614	4411

Notes: Standard errors are clustered on the region level and shown in the brackets. Both columns provide the TSLS result of Eq. (1) using the baseline instrument. Columns 1 follows the baseline specification. Column 2 excludes years with potential imputation, i.e. 2010-2012. All columns represent our preferred specification, i.e. demand and supply controls as well as region- and time-fixed effects. *** p<0.01, **p<0.05, *p<0.1.

A3 Migrant worker definition

The main data source for the project relies on the notifications (reports) sent by employers to the social security administration. Among other details, the employer is required to provide the nationality of each employee every time a report is sent. This implies that, in principle, the nationality of a given individual could change over time, due to naturalization or choosing to report different nationalities in case of a dual citizenship.

In order to minimize classification of foreigners as natives (e.g. due to naturalization), we assign foreigner status to those individuals whose first (un)employment episode we observe is associated with a non-German nationality (i.e. year 2000 for those arriving before that year, or a later year for those who enter employment in Germany for the first time after 2000). Having distinguished between Germans and foreigners using the above method, in our

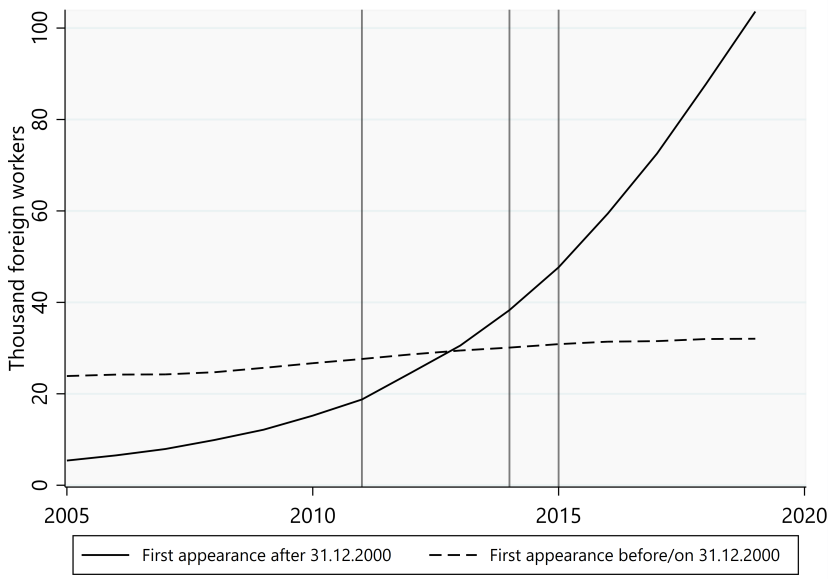
baseline analysis, we build the foreign staff-to-elderly ratios and the instrument on the sample of foreigners to those whose first episode ever recorded in the social security data appears in or after 2001.

The chosen definition allows us to avoid introducing measurement error in the shift-share instrument. In particular, we wish to distinguish between two groups of foreigners: i) older arrivals, in principle included in the historical composition of migrants, $\frac{Migrants_{c,r,2000}}{Migrants_{c,2000}}$, except if they had been naturalized; and ii) newer arrivals, which should be captured in the yearly migrant inflows after the base year of 2000.

Figure A3.1 plots foreign employment in long-term care by period of arrival (which we proxy with the first ever appearance in the social-security data), distinguishing between those arriving up to December 31, 2000, and those arriving in 2001 or later. It makes clear that it is the newly arrived that overwhelmingly take up work in the LTC, as opposed to the past migrants, inducing the time variation in the foreign LTC employment.

In line with this, Table A3.1 compares the baseline results with equivalent specifications in which the (endogenous) migrant stock and its instrument are constructed using all foreigners taking up LTC jobs (regardless of their arrival date). The resulting coefficient is similar to the baseline results, implying that the older migrants' LTC take-up is likely relatively small and stable across regions over time, such that it is absorbed by the fixed effects.

Figure A3.1: Evolution of foreign employment in LTC, by arrival date



Note: The figure counts the annual number of foreign LTC workers, distinguishing between two groups of foreigners: those arriving after the instrument base year (after 2000), and before that period. In the baseline specifications, we build the migrant stock and the migrant inflows (the *shift* in the instrument) based on the more recent arrivals only (as the older arrivals are captured by the historical *share*).

Table A3.1: Baseline regional results using all versus more recent migrants

	(1) Baseline	(2) All foreigners
Δ Foreign staff-to-elderly ratio	-0.464**	-0.489
	(0.208)	(0.311)
First-stage coefficient	0.525***	0.503***
	(0.112)	(0.130)
K-P F-statistic	21.991	14.902
Observations	5614	5614

Notes: Standard errors are clustered on the region level and shown in the brackets. Both columns represent TSLS estimation using our preferred specification, i.e. demand and supply controls as well as region- and time-fixed effects. In both columns, the instrument used is the baseline instrument. Column 1 follows the baseline specification and calculates the migrant staff-to-elderly ratio and the instrumented migrants inflows from the sample of foreigners who arrive in Germany after 2000. Column 2 includes all foreigners, no matter the day of arrival. *** p<0.01, **p<0.05, *p<0.1.

B Additional Figures and Tables

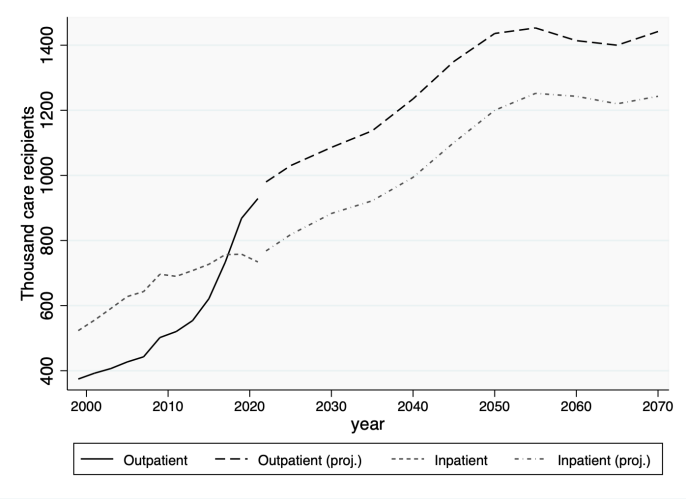


Figure B.1: Number and projection of formal care recipients, 1999-2070

Notes: For 1999-2021, Figure plots the number of care recipients by the type of care provided (Destatis, 2022a). The statistics are available on an biyearly basis, for odd years. From 2022 onwards, the figure plots a nursing projection (variant 1) published by the Federal Statistical Office (Destatis, 2023b). The forecast covers the year 2022 and then extends over five-year intervals from 2025 to 2070.

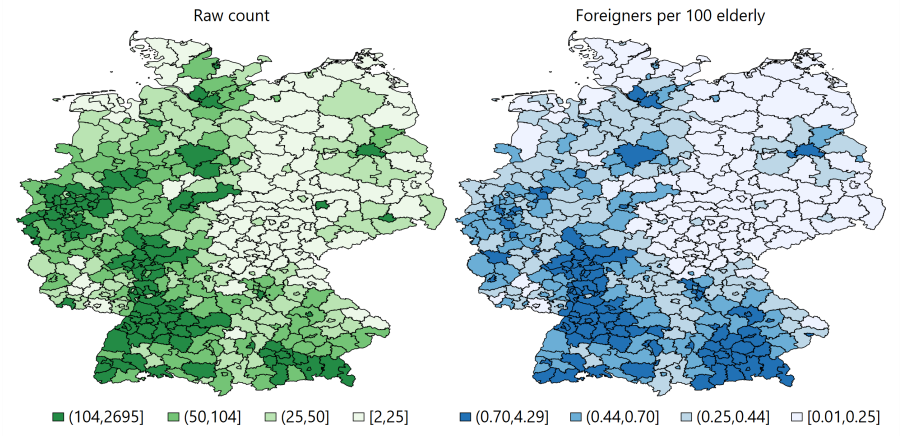


Figure B.2: Net change in foreign staff (LHS) and staff-to-elderly ratio (RHS), 2005-2015

Notes: The left figure displays the net change in the stock of foreign LTC workers between 2005 and 2015. The right figure displays this net change further standardized to reflect the number of nurses per 100 elderly (the staff-to-elderly ratio). Based on own calculations using the main dataset.

Table B.1: Characteristics of the insider and outsider sample in base year, 2010

Characteristics in 2010	Sample	
	Insider (n = 596,612)	Outsider (n = 43,719)
Female share, %	85.16	82.62
Mean age	41.74	40.22
Mean labor market tenure	19.91	18.42
Mean wage, €	1583.37	-
Nurse share, %	22.13	-
Outpatient share, %	30.84	-
Share unemployed for <= 2 years, %	-	72.42
Share unemployed with last LTC job <= 2 years ago, %	-	59.14

The presented means and proportions are unweighted.

Table B.2: Jaeger et al., 2018 implementation: first-stage results

	(1) Baseline	(2) Flow	(3) Flow, lag 1	(4) Flow	(5) Flow, lag 2	(6) Flow	(7) Flow, lag 3	(8) Flow	(9) Flow, lag 4
Instrumented flow	0.525***	0.105	-0.098	0.133	-0.149	0.274**	0.003	0.339***	-0.032
	(0.112)	(0.171)	(0.169)	(0.143)	(0.119)	(0.109)	(0.105)	(0.114)	(0.081)
Instrumented flow, lag 1		0.446**	0.704***						
		(0.204)	(0.173)						
Instrumented flow, lag 2				0.455***	0.864***				
				(0.168)	(0.134)				
Instrumented flow, lag 3						0.276	0.741***		
						(0.170)	(0.116)		
Instrumented flow, lag 4								0.126	0.893***
								(0.185)	(0.183)
Observations	5614	5213	5213	4812	4812	4411	4411	4010	4010

Notes: Standard errors are clustered on the region level and shown in the brackets. All regressions include demand and supply controls and region- as well as time-fixed effects. The flows and their lags are predicted by the baseline instrument. *** p<0.01, **p<0.05, *p<0.1.

Table B.3: Impact of foreign staffing on insider careers, full results

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Share of insiders:									
- still in LTC	-1.557***	-1.774***	-2.167***	-2.226***	-2.289***	-2.006***	-2.131***	-2.268***	-1.895***
	(0.335)	(0.504)	(0.465)	(0.460)	(0.470)	(0.476)	(0.471)	(0.469)	(0.420)
	80.556	71.191	66.885	63.160	59.654	56.620	53.693	51.046	48.010
- w/ job out of LTC	1.081***	1.322***	1.553***	1.600***	1.713***	1.639***	1.618***	1.463***	1.300***
	(0.290)	(0.437)	(0.402)	(0.385)	(0.395)	(0.416)	(0.396)	(0.375)	(0.348)
	9.678	15.842	18.100	19.911	21.422	22.581	23.752	24.546	25.533
- in unemployment	0.259***	0.401***	0.561***	0.368***	0.541***	0.473***	0.523***	0.479***	0.463***
	(0.090)	(0.102)	(0.135)	(0.121)	(0.129)	(0.126)	(0.149)	(0.127)	(0.141)
	2.571	3.292	3.713	3.788	3.562	3.370	3.111	2.963	2.845
- w/ other transition	0.216	0.050	0.053	0.259	0.035	-0.106	-0.010	0.326	0.132
	(0.154)	(0.171)	(0.226)	(0.246)	(0.235)	(0.240)	(0.240)	(0.260)	(0.248)
	7.195	9.675	11.303	13.141	15.362	17.429	19.444	21.444	23.613
- into retirement	0.125*	0.204**	0.235*	0.268**	0.208	0.143	0.099	0.144	0.052
	(0.073)	(0.099)	(0.127)	(0.126)	(0.135)	(0.133)	(0.145)	(0.163)	(0.176)
	0.969	1.975	3.029	4.215	5.775	7.467	9.194	11.180	13.438
Share of workers in jobs featuring:									
- less physical strain	0.641***	0.663***	0.818***	0.937***	0.964***	1.035***	1.040***	0.880***	0.933***
	(0.223)	(0.245)	(0.241)	(0.278)	(0.270)	(0.272)	(0.273)	(0.277)	(0.271)
	4.631	6.403	6.849	7.264	7.698	8.102	8.487	8.704	8.991
- less psychological strain	0.603***	0.506**	0.656***	0.809***	0.814***	0.873***	0.865***	0.733***	0.787***
	(0.228)	(0.244)	(0.236)	(0.271)	(0.257)	(0.246)	(0.246)	(0.244)	(0.239)
	4.878	6.800	7.348	7.844	8.320	8.759	9.197	9.450	9.737
- non-manual	0.701***	0.924***	0.982***	1.041***	1.020***	1.013***	0.864***	0.892***	0.970***
	(0.237)	(0.354)	(0.338)	(0.339)	(0.302)	(0.300)	(0.308)	(0.326)	(0.325)
	4.813	7.937	8.681	9.375	10.007	10.589	11.111	11.435	11.810
- analytical non-routine	0.203***	0.330***	0.320***	0.329***	0.424***	0.417***	0.405***	0.405***	0.390***
	(0.071)	(0.085)	(0.086)	(0.084)	(0.090)	(0.094)	(0.090)	(0.124)	(0.122)
	0.690	1.036	1.159	1.294	1.413	1.540	1.669	1.750	1.877
- interactive non-routine	0.212	0.083	0.052	0.117	-0.007	-0.010	0.001	-0.027	0.025
	(0.212)	(0.370)	(0.346)	(0.320)	(0.307)	(0.279)	(0.277)	(0.289)	(0.295)
	3.212	5.442	5.753	6.030	6.317	6.538	6.695	6.712	6.758
- cognitive routine	0.287***	0.511***	0.609***	0.595***	0.603***	0.605***	0.459***	0.514***	0.555***
	(0.065)	(0.095)	(0.108)	(0.120)	(0.113)	(0.111)	(0.108)	(0.129)	(0.134)
	0.911	1.459	1.769	2.052	2.277	2.511	2.747	2.973	3.175
- manual routine	-0.001	-0.043	-0.026	-0.064	-0.049	-0.035	-0.041	-0.034	-0.040
	(0.023)	(0.034)	(0.034)	(0.040)	(0.038)	(0.037)	(0.041)	(0.038)	(0.038)
	0.192	0.306	0.338	0.384	0.416	0.427	0.444	0.460	0.461
- manual non-routine	-1.226***	-1.307***	-1.566***	-1.611***	-1.564***	-1.359***	-1.348***	-1.673***	-1.538***
	(0.296)	(0.427)	(0.404)	(0.436)	(0.397)	(0.404)	(0.383)	(0.409)	(0.393)
	85.274	79.038	76.189	73.444	70.691	68.192	65.882	63.683	61.244
Difference in log wage (vs 2010)	0.013***	0.022***	0.026***	0.028***	0.027***	0.031***	0.032***	0.037***	0.040***
	(0.005)	(0.006)	(0.008)	(0.007)	(0.008)	(0.009)	(0.009)	(0.011)	(0.011)
	0.086	0.139	0.192	0.233	0.278	0.312	0.353	0.390	0.430
First-stage coeff.	0.737***	0.737***	0.737***	0.737***	0.737***	0.737***	0.737***	0.737***	0.737***
	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)
K-P F-stat.	18.159	18.159	18.159	18.159	18.159	18.159	18.159	18.159	18.159

Notes: Table presents the baseline effect of an increase of one foreign LTC worker per 100 elderly on a given outcome (row) in a given year (column), estimated with TSLS and the baseline instrument. For each outcome-year combination, we present the coefficient, robust standard error in brackets and the mean dependent variable. All models include regional supply and demand controls as well as worker group controls, all fixed in 2010. Difference in wage is calculated on a sample of those employed in a given year. *** p<0.01, **p<0.05, *p<0.1.

Table B.4: Average change in number of foreign LTC workers per 100 elderly, since 2010

2011	2012	2013	2014	2015
0.040	0.107	0.173	0.258	0.371
2016	2017	2018	2019	
0.514	0.676	0.859	1.050	

Notes: Table reports the mean value of the following difference: (realized stock of LTC in a given year - realized stock of LTC workers in 2010), taken over the 401 regions.

Table B.5: Heterogeneity group sizes and proportions in 2010, insider sample

		Work type					
		Nurse		Assistant		Social worker	
Type of	Out	69319	(11.62%)	37789	(6.33%)	76861	(12.88%)
service	In	62701	(10.51%)	104054	(17.44%)	245888	(41.21%)

Notes: Table reports the number and proportion of applicable native individuals across the two heterogeneity dimensions.

Table B.6: Impact of foreign staffing on outsider careers, full results

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Share of insiders:									
- still in LTC	-1.682**	-1.517**	-1.595**	-1.076	-1.659**	-1.743**	-1.268	-1.910**	-1.211*
	(0.706)	(0.663)	(0.669)	(0.694)	(0.767)	(0.735)	(0.775)	(0.808)	(0.705)
	13.723	16.616	17.795	17.514	17.831	17.813	17.694	17.456	17.121
- w/ job out of LTC	0.236	0.667	-0.456	-0.384	-0.621	-0.317	-0.501	0.384	0.408
	(0.679)	(0.741)	(0.840)	(0.856)	(0.910)	(0.773)	(0.820)	(0.844)	(0.736)
	21.068	25.923	27.681	29.448	29.873	30.609	31.204	31.484	31.734
- in unemployment	4.230***	3.894***	3.529***	3.413***	3.939***	3.601***	3.876***	3.294***	3.122***
	(1.477)	(1.271)	(1.296)	(1.280)	(1.128)	(1.005)	(1.155)	(0.900)	(0.901)
	42.938	30.552	25.825	22.657	20.143	17.960	15.781	14.068	12.862
- w/ other transition	-2.783***	-3.045***	-1.479*	-1.953**	-1.660**	-1.541**	-2.108***	-1.768***	-2.319***
	(0.934)	(0.753)	(0.761)	(0.805)	(0.761)	(0.697)	(0.752)	(0.661)	(0.713)
	22.271	26.909	28.699	30.381	32.153	33.618	35.321	36.992	38.282
- into retirement	-0.666**	-1.285***	-1.510***	-1.192***	-1.159***	-1.216***	-1.253***	-1.112**	-0.876*
	(0.317)	(0.434)	(0.455)	(0.449)	(0.444)	(0.434)	(0.431)	(0.433)	(0.460)
	4.697	7.881	9.368	10.664	12.023	13.303	14.658	16.142	17.814
First-stage coeff.	0.737***	0.737***	0.737***	0.737***	0.737***	0.737***	0.737***	0.737***	0.737***
	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)	(0.169)
K-P F-stat.	20.277	20.277	20.277	20.277	20.277	20.277	20.277	20.277	20.277

Notes: Table presents the baseline effect of an increase of one foreign LTC worker per 100 elderly on a given outcome (row) in a given year (column), estimated with TSLS and the baseline instrument. For each outcome-year combination, we present the coefficient, robust standard error in brackets and the mean dependent variable. All models include regional supply and demand controls as well as worker group controls, all fixed in 2010. Difference in wage is calculated on a sample of those employed (regardless of the sector) in a given year. *** p<0.01, **p<0.05, *p<0.1.

Table B.7: Heterogeneity group sizes and proportions in 2010, outsider sample

		Years in unemployment	
		1 - 2	>= 3
Years since	1 - 2	-	25855 (59.14%)
last LTC job	>= 3	12057 (27.58%)	5807 (13.28%)

Notes: Table reports the number and proportion of applicable native individuals across the two heterogeneity dimensions.

C Additional robustness checks

C1 Robustness to methods of controlling for elderly population

We further check if the results are robust to the different ways of controlling for the local size of the elderly population. In particular, our baseline analysis defines the regional native (foreign) staff-to-elderly ratios as the number of native (foreign) workers, divided by the start-year size of the elderly population in that region, 2005. To alleviate the concern that the observed effects are driven by the particular choice of the denominator, we re-estimate our preferred specifications using different constructions of the staff-to-elderly ratios. We present the results in Table C1.1. Column 2 constructs the ratios using regional elderly population sizes fixed in year 2000, which is the shift-share base year; in Column 3, we use the baseline method but further control for regional elderly population growth. In Column 4, we use raw stocks, rather than ratios, and explicitly use the size of the elderly population as another explanatory variable. Overall, the baseline regional staffing results are robust to different definitions of the staff-to-elderly ratios, providing evidence against a particular method of scaling the staff stocks driving our results.

Table C1.1: Regional results on the impact of immigration into LTC on the native employment: various procedures to control for elderly population

	(1) Baseline	(2) $Elderly_{2000}$	(3) Elderly growth	(4) Raw stocks
Dependent variable: Δ Native staff-to-elderly ratio				
Δ Foreign staff(-to-elderly ratio)	-0.464**	-0.479**	-0.460**	-0.615**
	(0.208)	(0.194)	(0.208)	(0.248)
First-stage coefficient	0.525***	0.510***	0.525***	0.499***
	(0.112)	(0.114)	(0.112)	(0.049)
K-P F-statistic	21.991	19.896	22.002	106.071
Observations	5614	5614	5614	5614

Notes: Standard errors are shown in the brackets. All columns show the result of a TSLS estimation, employing the baseline instrument. Column 1 copies the baseline result (Column 4 of Table 4). Column 2 defines the staff-to-elderly ratios in terms of the elderly population size in 2000 (shift-share base year). Column 3 follows the baseline specification, but includes region-specific, year-on-year growth rate of the elderly population as an additional control. Column 4 estimates the preferred specification using raw foreign stock, but including the $t-1$ elderly population size as a control. *** p<0.01, **p<0.05, *p<0.1.

C2 Instrumenting with total migrant inflows

Unlike in related literature, we use national net inflows of foreign *LTC* workers (as opposed to foreign workers more generally). This allows us to more precisely measure the potential substitutability (or complementarity) between the foreigners and the natives, both insiders and outsiders.

Nonetheless, for completeness, we complement our main analysis by constructing another instrument, this time including all foreign residents in a region, as well as all female foreign residents. The underlying source of the data coincides with one used to construct the historical share in the baseline instrument in Equation 3, implying that the now-proposed aggregate shift-share features the same *share*, but a different *shift*, than the original instrument.

Table C2.1 presents the results. We first note that the raw correlation of the nation-wide, country-specific inflows of migrants between the baseline and aggregate instruments are 0.38 (for all foreigners) and 0.42 (for female foreigners), indicating that the total LTC foreign staff features a different country-of-origin composition to the full foreign sample in Germany.[31] Accordingly, we find that the alterations of our shift-share formula yield comparatively weaker instruments. Furthermore, while native displacement is found across both specifications, the coefficients are no longer statistically significant.

[31] Some of the cause for this may be data driven: we are unable to exactly follow our "migrant" definition in the aggregate data (see Section A3). In particular, we are unable to distinguish the older migrants from plausibly recent arrivals when calculating the *shift*.

Table C2.1: Effect of LTC immigration on native staff-to-elderly ratio, aggregate migration instrument

	(1)	(2)	(23
	Baseline	All foreigners	Women
Δ Foreign staff-to-elderly ratio	-0.464**	-0.206	-0.192
	(0.209)	(0.378)	(0.339)
First-stage coefficient	0.525***	0.004***	0.011***
	(0.112)	(0.001)	(0.003)
K-P F-statistic	21.991	12.236	10.918
Observations	5614	5614	5614

Notes: Standard errors are clustered on the region level and shown in the brackets. All columns represent our preferred specification, i.e. demand and supply controls as well as region- and time-fixed effects, estimated with TSLS and the baseline instrument. Column 1 follows the baseline specification. Column 2 instruments the foreign staff-to-elderly ratio with a shift-share instrument using changes in local stocks of foreign residents (regardless of occupation/employment and gender). Column 3 builds the instrument using changes in local stocks of foreign women (regardless of employment). *** p<0.01, **p<0.05, *p<0.1.