No place for young women? The impact of internal migration on adult sex ratios in rural East Germany

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Abstract:

Shortages of women in rural areas are a phenomenon in many highly urbanized countries. Rural East Germany is an ideal case to study this phenomenon, because of its low adult sex ratios (ASRs) – men greatly outnumber women – coupled with high out-migration among young adults. This study researches how internal migration between rural and urban areas contributes to the shortage of young adult women. We use data on inter-county migration flows (years 2002–2021) to decompose the impacts of migration on ASRs. We find that the low ASRs in rural East Germany are due to sex-selective migration. The main destination of these sex-selective flows was West Germany in the early 2000s, while in the 2010s urban areas in the East were the important destinations. We find that movements among 20–24-year-olds increase the shortage of women in the rural population, while the 25–29-year-olds contribute to more balanced ASRs.

Keywords: Germany, internal migration, sex ratios, rural areas, woman shortages, population redistribution

1   Introduction

In many European countries, regional variation in internal and international migration tends to be a more important driver of regional population structures than regional differences in fertility and life expectancy (Bujard 2011; Rees et al. 2017; Stawarz and Sander 2020; Wenau et al. 2019). The impact of migration on regional age and sex structures is especially pronounced if migration is strongly selective by age and sex. The consequences of the selective migration streams are far reaching and, for example, can lead to declines in human capital, accelerated population aging as well as sex ratios imbalances (e. g. Menashe-Oren and Stecklov 2023). For instance, a shortage of women due to sex-selective out-migration has strong implications for relationship formation and stability (Eckhard and Stauder 2018; Edlund 2005), is associated low birth rates (Dinkel and Milenovic 1993; Eckhard 2010) and seems to be associated with increased crime rates and radical political opinions (Barber 2003; Kröhnert and Klingholz 2007).

Rural East Germany is among the regions with the lowest female to male ratio in Europe – in some areas below 70 women per 100 men aged 18–30 years (Leibert 2016). These imbalances are commonly attributed to female-dominated migration flows from East to West Germany. After all, internal migration accounts for high net population losses of around 1.2 million people since reunification, though moves between East and West Germany are balanced since 2017 (Stawarz et al. 2020). These flows have been argued to be highly selective by sex with more women than men leaving East Germany (e.g. Kröhnert and Vollmer 2012). However, this interpretation does not consider the sex ratios of flow and counterflow between East and West, nor does it account for selective out-migration to urban areas in the East (Rosenbaum-Feldbrügge et al. 2022). The sex ratio of migration between East and West is indeed skewed towards females, but this is mainly the result of more men than women moving from West to East, while females and males move to a similar extent from East to West Germany (e.g. Fuchs-Schündeln and Schündeln 2009; Kühntopf and Stedtfeld 2012; Stauder 2018). Moreover, since around 2005, the overall rate of males migrating from East to West exceeds the rate of women, while the sex ratio imbalances of West to East migration has decreased (Stawarz et al. 2020). A reason for this may be that East German cities have increasingly become attractive destinations for both women and men (Buch et al. 2013; Ganesch 2018). Higher incidences of rural to urban migration of women are a well-documented phenomenon in many highly urbanized countries (Corbett 2007; Dahlström 1996; Edlund 2005; Hamilton and Otterstad 1998; Walsh 2013). This pattern has been found in Germany as well (Berentsen 1996; Kubis and Schneider 2007; Schmidt and Tittel 1990; Wendt 1994), but little is yet known about the impact of rural-urban migration compared to East-West migration on rural adult sex ratios (ASRs).

The aim of this paper is to bridge this gap by providing a detailed picture of the ways in which internal migration impacts on the ASR in rural East Germany. We differentiate between the impact of East-West migration and rural-urban migration to determine their relative consequences and

how they changed over time. Given that we focus on ASRs and that the intensity of internal migration is highest in young adult ages, we focus on internal migration flows of the age group 18–29 years. We draw on a time-series data set of annual inter-county migration flows for the years 2002 to 2021 from the Federal Statistical Office of Germany and the Statistical Offices of the Länder, which was compiled and adjusted for boundary changes by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR). Unfortunately, migration flows by sex are only available since 2002. We use descriptive indicators like net internal migration rates and an adapted version of the compositional impact of migration (CIM) index proposed by Rodríguez-Vignoli and Rowe (2018) to study how internal migration has influenced sex ratios in rural East Germany.

2   Theoretical considerations

From an economic perspective, internal migration flows are the result of individual decisions based on utility maximization, which are often initiated by individuals' desire for a change or the dissatisfaction with the current situation (e.g. Kley 2011; Sjaastad 1962). In the decision-making process, the subjectively perceived monetary (e.g. income) and non-monetary (e.g. quality of life) benefits and costs are weighed against each other. The decision to migrate is made when the benefits outweigh the costs. Underlying local disparities, like wage differentials and job markets, may shape the migration decisions (e.g. Borjas et al. 1992; Burda and Hunt 2001; Fielding 1992; Ganesch 2018). Furthermore, migration motives draw migration decisions and lead to typical age-specific migration patterns (Bernard et al. 2014; Mulder 1993; Plane and Jurjevich 2009; Stawarz and Sander 2020). While educational reasons (e.g. finding an apprenticeship or starting their studies) are the main motive for migration decisions among young adults aged 18–24 years, job reasons typically become more prevalent for persons aged 25–29 years. Moreover, variations in internal migration flows are related to individuals' educational level: higher educated persons can be assumed to be more spatially mobile as they are more likely to expect that rewards through migration pays off. Besides, spatial mobility can be seen as an investment into human capital to achieve higher wages and job matches especially for the highly educated (Becker 1975; Sjaastad 1962).

With these basic theoretical explanations at hand, we can derive assumptions on sex- and age-specific differences in migration patterns to and from rural East Germany. First, regarding ages 18–24, young women qualify for jobs in the service sector more often than young men and reach higher educational degrees in Germany (Helbig 2012; Helbig and Leuze 2012; OECD 2022). As the possibilities to study and to find apprenticeships are limited in rural East Germany – especially in the tertiary sector –, more young women than men follow the greater supply in West Germany as well as in cities in general (Buzar et al. 2007; Gans 2017; Kröhnert and Klingholz 2007; Mai 2006; Siedentop 2008). Moreover, East German universities are more aligned to STEM fields, which are less often compatible with gendered occupational aspirations of women (Klemm and Thomas

2010; Weiss and Isermann 2003). Surveys have shown that young adult women are more likely to leave East Germany for educational reasons than their male counterparts (Eckhard and Stauder 2018), are less likely to leave areas with strong service sector (Leibert 2016), and more often internally migrate because of limited employment or tertiary educational opportunities (Dienel et al. 2004; Fuchs-Schündeln and Schündeln 2009; Kubis and Schneider 2007; Steiner 2004; Wiest 2016; Wiest and Leibert 2013). In sum, the limited supply of tertiary education and apprenticeships in the service sector leads to a higher number of internal migration flows of East German women aged 18–24 years from rural East to West Germany or to East German cities in contrast to men of the same age. In consequence, this should contribute to low ASRs in the rural East.

Second, for young adults aged 25–29, occupation-related migration becomes more prevalent than for younger adults. Advantages with regard to higher wages and lower unemployment rates in West over East Germany as well as in urban over rural areas promote moves from the rural East to West Germany and to cities in general (Belitz et al. 2019; Buch et al. 2013; Gans 2017; Krause 2019). Therein, studies show that men – especially the low educated – move more often from the East German areas for better employment opportunities and career prospects than women (Dienel et al. 2004; Melzer 2013; but see Stauder 2018). Higher out-migration of men aged 25–29 years from the rural East thus yields a more balanced ASRs in rural East Germany.

3 Data and methods

We draw on a time-series dataset of annual inter-county migration flows (years 2002–2021) and population data (years 1991–2021) from the German Federal Statistical Office and the Statistical Offices of the Länder (territorial status 2021). We do not include migration flows for the period 1991–2001 because the data are not available by sex. The dataset on internal migration flows was originally compiled and adjusted for boundary changes by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2010). The data capture the number of all changes of residence across the 400 counties' (Kreise) boundaries (e.g. between Leipzig and Cologne) for each single year. The data are reliable as persons relocating within Germany are legally required to register at their new address at the municipal level. We differentiated internal migration flows by two age-groups, 18–24 years and 25–29 years, and associate them with data on the respective population living in each county.

To determine internal migration between rural and urban areas, we aggregated the data to a regional typology developed by the BBSR (Milbert 2015), which distinguishes between largest cities, cities, hinterland, and rural areas. We adapted the classification so that the largest cities and cities define urban areas while hinterland and rural areas define rural areas. We consider Berlin as an extra category because it was divided between East and West Germany before reunification.

We calculated ASRs for rural East Germany by taking the ratio of the female-to-male population. We use the female-to-male ratio to make our result comparable to earlier work on the impact

of migration on sex ratios (Rodríguez-Vignoli and Rowe 2018). To determine how the flows to different regions contribute to the changes in the population we calculate net internal migration rates (Bell et al. 2002):

$$N_i = 100(I_i - O_i)/P_i \qquad (1)$$

where I_i are the total inflows, O_i the total outflows, and P_i is the population of region i in a given year. As population count, we deploy the population mean of the corresponding year with the year before. To better compare the size of net migration rates, we present them within one figure as stacked values. Moreover, we deploy the compositional impact of migration (CIM) index proposed by Rodríguez-Vignoli and Rowe (2018) to quantify the influence of specific internal migration flows on ASRs in rural East Germany. The CIM measure gives us an idea of how internal migration contributes to the absolute changes of the ASRs in rural East Germany. In our case, the CIM index is computed as follows:

$$CIM = 100\left(\frac{P_{ii}(f) + I_i(f)}{P_{ii}(m) + I_i(m)} - \frac{P_{ii}(f) + O_i(f)}{P_{ii}(m) + O_i(m)}\right) \qquad (2)$$

where P_{ii} is the size of the stayer population and their sex composition (f and m) in a given year, defined by the population at the end of a year minus the inflows.[1] I_i and O_i are the magnitudes of in- and out-migration flows, each by sex (f and m). Moreover, we can decompose the CIM index into the impacts of the in- and out-migration flows (CIM^I and CIM^O). In our case, these indices are calculated as follows:

$$CIM^I = 100\left(\frac{P_{ii}(f) + I_i(f)}{P_{ii}(m) + I_i(m)} - \frac{P_{ii}(f)}{P_{ii}(m)}\right) \qquad (3)$$

$$CIM^O = 100\left(\frac{P_{ii}(f)}{P_{ii}(m)} - \frac{P_{ii}(f) + O_i(f)}{P_{ii}(m) + O_i(m)}\right) \qquad (4)$$

For a mathematical derivation of the CIM index and the adaption to other measures see Rodríguez-Vignoli and Rowe (2018).

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[1] The CIM index is originally introduced by using census data, where the non-mobile population can be found in the diagonals of a census-based origin-destination matrix of internal migration flows. Our data consists of internal flow data, where the diagonals are traditionally zero. The population data we use to fill the diagonals are measured at the end of a year. In order to get as close as possible to the proposed approach by Rodríguez-Vignoli and Rowe (2018) we calculate the non-mobile population as described. However, another way is to use the mean of the population of the corresponding year and the year before. A robustness check shows that this leads in our case to very similar results and the corresponding CIM values only differ in the second decimal place compared to those reported in text.

4   Results

By way of background, we first provide an overview of how the population sex structure in rural East Germany changed over time since reunification. Figure 1 shows the female and male populations aged 18–29 years living in rural East Germany and the corresponding ASRs over the period 1991–2021. The ASRs for urban areas in East Germany are added as a reference. The detailed numbers for the ASRs and those for West Germany are depicted in Table A1 in the appendix.

Figure 1a reveals that the male and female population in rural East Germany aged 18–29 years decreased strongly since reunification, though the pace of this decline has differed over time. The main drivers were declining birth rates and large internal migration from East to West Germany (Goldstein and Kreyenfeld 2011; Stawarz et al. 2020). In the early 1990s, the East German population shrunk because of high levels of out-migration. In the early 2000s, this decline slowed down and in parts balanced because of a cohort effect: as of the late 1970s, the GDR government aimed to counter both the second demographic transition and the shortage of workers with legislations that fostered both fertility and female employment (e.g. expansion of childcare facilities as well as financial and material advantages) (Kreyenfeld 2004). This resulted in large birth cohorts in the late 1970s and early 1980s, which, however, were followed by decreasing cohort sizes during the 1980s. Following the German reunification, the total fertility rate (TFR) in East Germany dropped from 1.6 in 1989 to the historical low of 0.8 in 1993, which explains much of the strong population decrease since the mid-2000s. In 2020 and 2021, the population decline seems to have stabilized.

Figure 1b, additionally, depicts a greater number of males aged 18–29 years living in rural East Germany than females, which is reflected in the very low ASRs. In the years after German reunification, we find decreasing ASRs in rural East Germany from around 94 women per 100 men in 1991 to only 84 women in the period 2001 to 2009. As of 2009, the ASRs reflect a slight balancing of females and males until 2014, but in 2015 and 2016, the ASR declines again most probably as a result of large numbers of young male refugees arriving in Germany (Federal Ministry of the Interior and Community, BMI 2021; Kraus et al. 2019). In the years after, the ASRs started to balance again slightly until 2021. Furthermore, Figure 1b reveals strong differences in ASRs for urban and rural areas in East Germany. Except for the early 1990s, the ASR is substantially higher, although still below 1, in urban areas. This pattern is also observed for West Germany, although with less deviation from a balanced ASR and less variation over time (see Table A1).

Figure 1. Female and male population and ASR for rural East Germany, persons aged 18–29 years
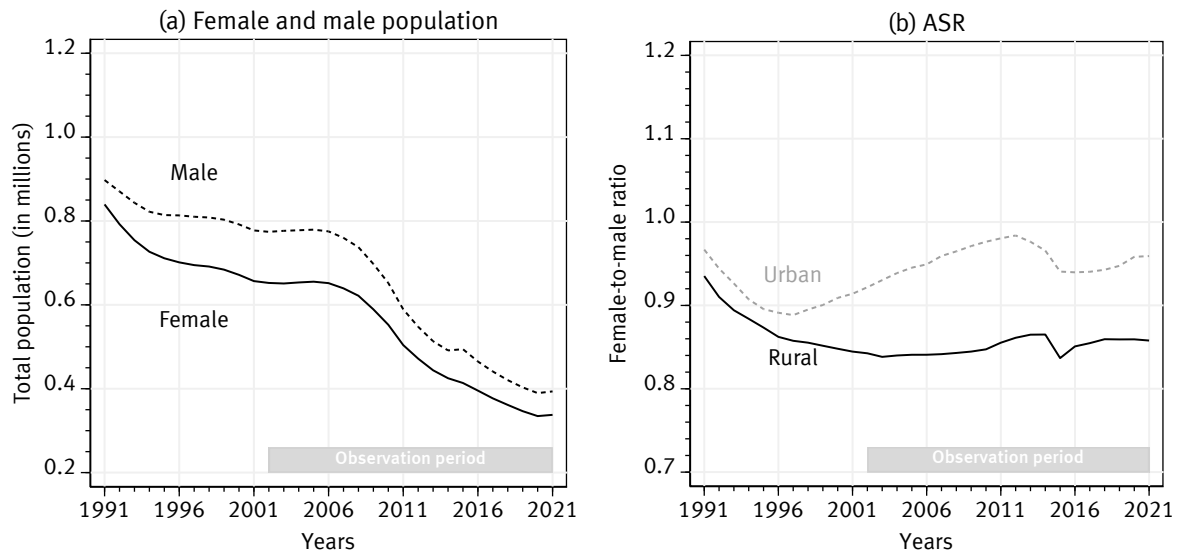
Data: Federal Statistical Office Germany and the Statistical Offices of the Länder

To determine the impact of internal migration on rural ASRs, we first calculate net internal migration rates between rural East Germany and other regions for our two age-groups in the period 2002–2021. Figures 2 and 3 show the stacked net internal migration rates by age group and sex.

Figure 2 shows strong net losses for both males and females aged 18–24 years in rural East Germany. During the 2000s, the deficit in net rates is particularly great for women, with total yearly losses of up to -6.1 percent for women and -4.2 percent for men. The largest driver is net migration flows to the urban West (up to -3.0 percent for women and -1.7 percent for men). During the 2010s, net migration flows to the urban West lose relevance, especially among females (down to -0.8 percent for women and -0.6 percent for men) – with the exception of the year 2016 when the redistribution of refugees across Germany was captured in the register as internal migration. Simultaneously, net migration to the rural West also declined over time, though on a much smaller scale. Meanwhile, throughout both the 2000s and 2010s, net migration to the urban East greatly gains relevance by about 2 to 3 percentage points (from -1.2 to -3.7 percent for women and from -0.7 to -2.8 percent for men), with a slight decline in the late 2010s.

For 25–29-year-olds adults, the rates are smaller overall and the pattern by sex is reversed (see Figure 3). We find that rural East Germany lost more males of that age through internal migration than females, with yearly total net losses of up to -3.3 percent for men and merely up to -2.5 percent for women. This disparity intensified over time. Since 2019, we even find net internal migration gains for women (up to 1.0 percent) while they continue to be slightly negative for men (around -0.4 percent). Similar to the younger age group, though on a much smaller scale, the greatest losses in the 2000s occur because of net internal migration to urban West Germany (up to -1.7 percent for men and -1.3 percent for women). Again, the rates become less negative over time. For

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women, they approach zero in 2021, while for men the losses to urban regions in West Germany are slightly negative with -0.4 percent. Interestingly, the urban East does only gain relevance – relative to other regions – for 25–29-year-olds women with even positive net rates, but not for men, like it does among the younger age groups with regard to population losses. In recent years, we even find slight net internal migration gains from the urban East (women up to 0.7 percent since 2019, and men up to 0.1 percent since 2020). The same is true for internal migration flows with Berlin, though we find slight population gains for women as of the pandemic while men's net rates approach zero.

In sum, the analyses reveal that the disproportionate out-migration of females from rural East led to shortages of women aged 18–24, which partially levelled off over time because of the greater out-migration of men aged 25–29 and positive net internal migration of women since 2019. The greatest net migration losses occurred with urban destinations, though urban West German areas greatly lost relevance over time.

Figure 2: Stacked net migration rates for females and males by regions, aged 18–24 years
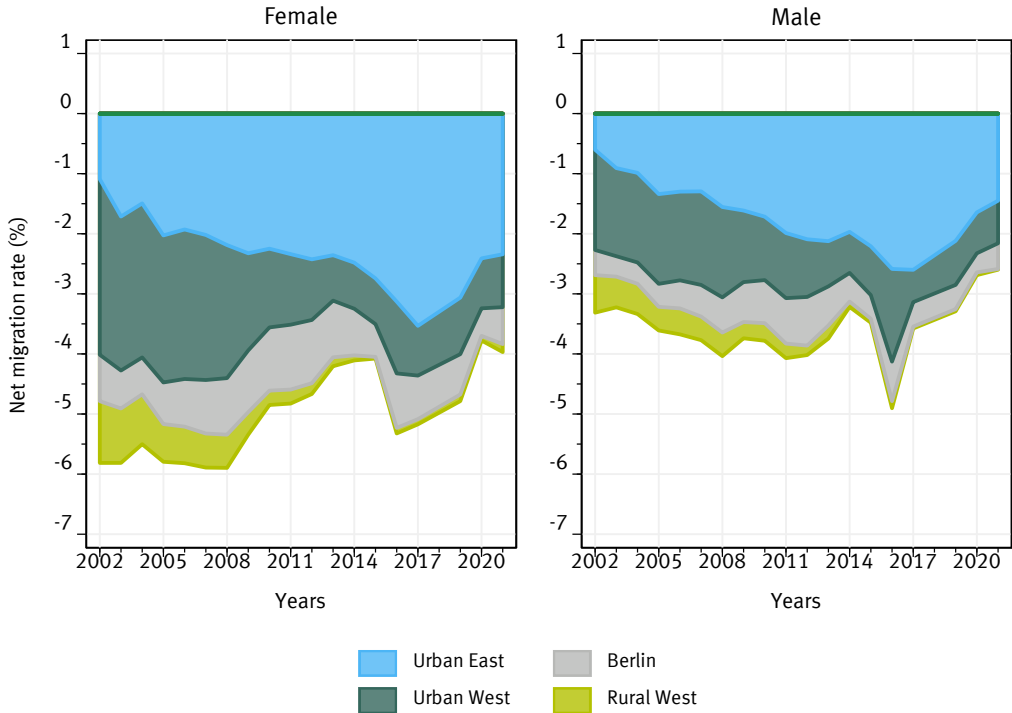
Data: Federal Statistical Office Germany and the Statistical Offices of the Länder

Figure 3: Stacked net migration rates for females and males by regions, aged 25–29 years
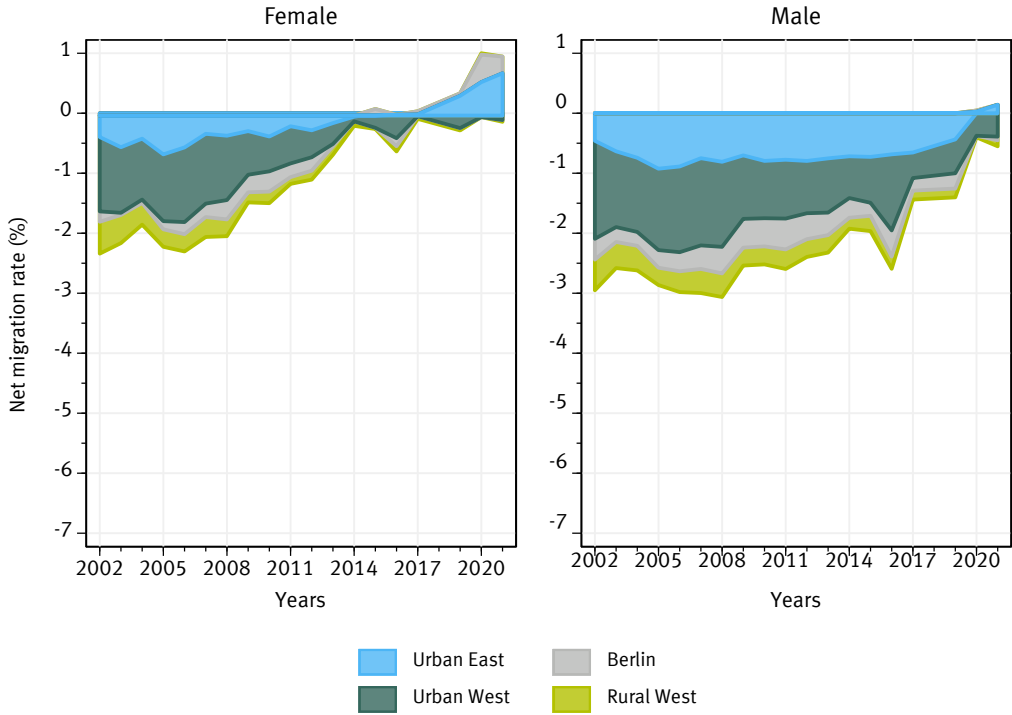
Data: Federal Statistical Office Germany and the Statistical Offices of the Länder

Next, we analyse how migration flows between rural East Germany and other regions affect ASRs using the CIM index, which captures the changes of the ASRs in the rural East due to internal migration with different destination categories (see Figures 4 and 5). CIM index values below zero indicate a decrease in the ASR through internal migration, while positive values indicate an increase in the ASR. In other words, negative index values mean that internal migration aggravates the shortage of women in the rural East, while positive index values mean that internal migration alleviates it.

For 18–24-year-olds, the overall CIM index is negative for all destination categories in most years (see Figure 4). The overall pattern is driven by strongly negative index values for outflows from the rural East and predominantly positive values for inflows. When looking at the index values for outflows for the four destination categories, we find that outflows to the urban East and to the urban West (especially in the earlier years) were the main drivers of the negative impact on rural ASRs. Note that the peaks in 2015 and 2016 – which we will not discuss here in detail – result from the redistribution of refugees being captured as internal migration.

Conversely, we find that inflows to rural East Germany contribute to balancing the ASRs, because more females than males migrate to rural East Germany. The positive CIMs are highest for inflows from urban East with values of at times more than 0.5 points (2007–2013 and 2018–2021) and lowest for flows from rural West with values consistently around 0.2 points. However, the disproportionate outflows mostly eradicate this effect, as seen in the negative overall index values.

The internal migration behaviour of 18–24-year-olds adults tended to aggravate the shortage of women. The analysis of the CIM index shows that migration to West Germany (rural and urban areas) had a strongly negative effect on ASRs in the rural East, but only in the first half of the study period. In the 2010s, the CIM values for moves to urban and rural West were close to zero, suggesting that the sex ratio of these flows became more and more balanced over time.

For 25–29-year-olds, the CIM index suggests that internal migration has a much more nuanced impact on the ASR in rural East Germany (see Figure 5). The overall CIM index is slightly positive for all destination categories. This means that the sex composition of these migration flows leads to more balanced ASRs in rural East Germany. In most years, more women than men move to rural East Germany and less women than men out-migrate from rural East Germany (a notable exception are flows from and to Berlin until 2010). During the 2000s, the overall CIM values tend to be only marginally positive. Therefore, the older age group contributes to a lesser extent to shifts in the ASRs int these years, compared to the more negative CIMs for the 18–24-year-olds. In the 2010s, CIM index values for 25–29-year-olds increased slightly due to the outflows from rural East Germany becoming more male-dominated.

In the final years of the study period, the outflows to urban East among 18–24-year-olds showed the highest (negative) CIM values among all destination categories and age groups, suggesting that this type of flow had the strongest impact on the ASR in rural East. The impact of internal migration to West Germany, however, declined in importance. The negative influence of the migration behaviour of the 18–24-year-olds on the ASRs is, however, increasingly compensated by the migration behaviour of 25–29-year-olds.

Figure 4. CIM index for ASRs in rural East Germany by region, persons aged 18–24 years
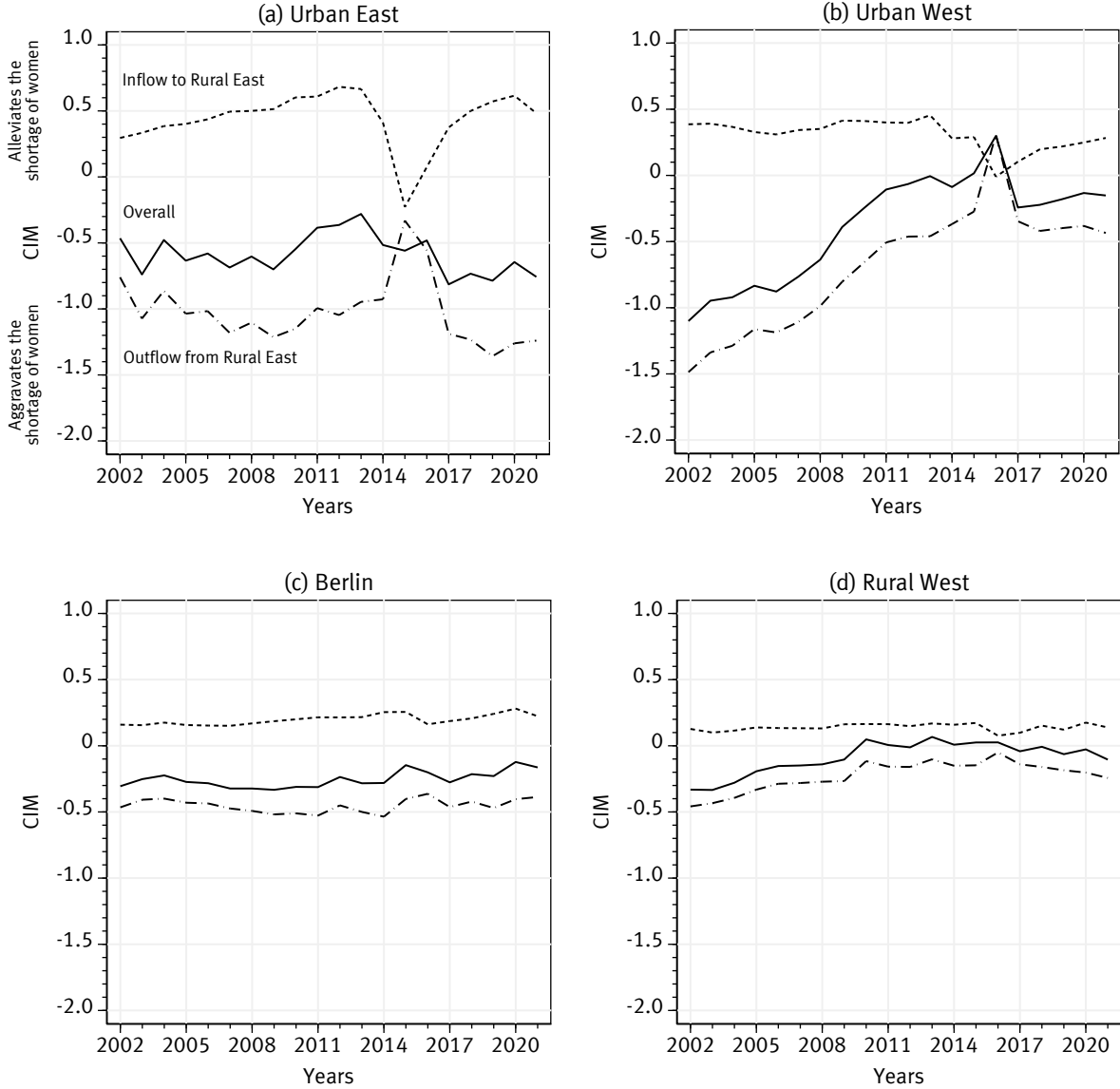
Data: Federal Statistical Office Germany and the Statistical Offices of the Länder

Figure 5. CIM index for ASRs in rural East Germany by region, persons aged 25–29 years
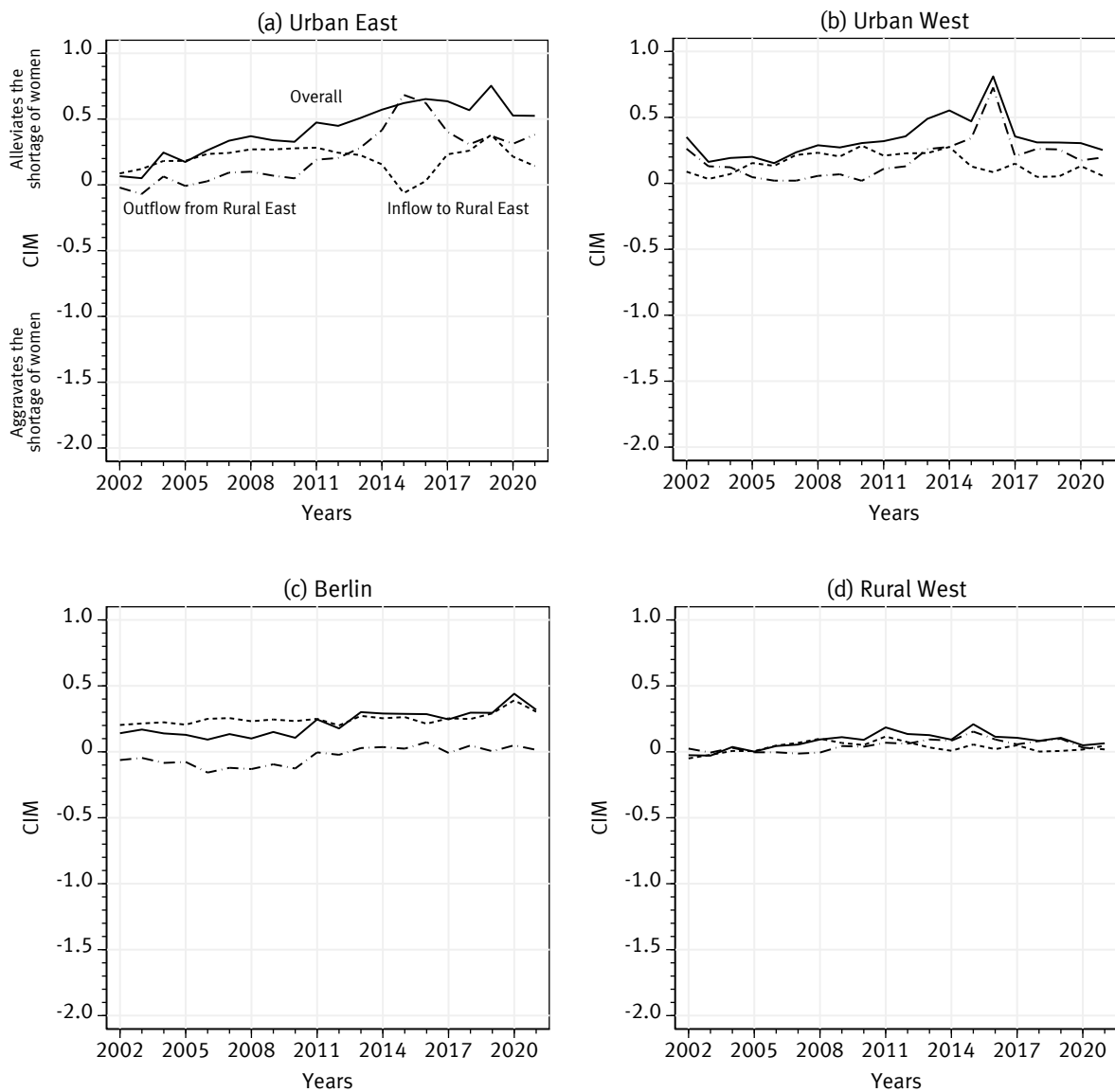
Data: Federal Statistical Office Germany and the Statistical Offices of the Länder

5 Summary and discussion

In the decades following reunification in 1990, rural East Germany has experienced high levels of net population losses as well as remarkably low female to male sex ratios among young adults (e.g. Leibert 2016; Rosenbaum-Feldbrügge et al. 2022; Stawarz et al. 2020). In the literature, both phenomena are typically attributed to large migration flows to the economically stronger West Germany (Fuchs-Schündeln and Schündeln 2009; Kröhnert and Vollmer 2012; Stauder 2018), but this relationship has not been studied thoroughly with regards to destination categories in East and West. In this paper, we put the developments in wider context by looking at both migration from rural East to West Germany and to urban East Germany, thereby focusing on the most mobile young

adult population aged 18–29. Moreover, we deploy a compositional impact of migration (CIM) index to directly estimate the impact of internal migration flows on ASRs in rural East Germany (Rodríguez-Vignoli and Rowe 2018).

Our results reveal that the migration behaviour of the 18–24-year-olds aggravate the negative ASRs – where men outnumber women – in the rural East. This impact is, however, weakening since the 2000s. Conversely, internal migration among the 25–29-year-olds tends to alleviate the negative ASRs and its influence is increasing during the observation period. Overall, in the 2000s internal migration flows of young adults aged 18–29 lead to more imbalanced ASRs in the rural East, during the years 2011–2016 to a greater equilibrium, and since 2017 the influence on ASRs in rural East Germany is nearly zero. In the 2000s, furthermore, sex-selective migration of the 18–24-year-olds from the rural East to urban and rural areas in West Germany accounted for the greatest loss of women. In the 2010s, however, the picture changed and sex-selective migration between the rural East and the urban East emerged as the driving factor. While the impact of outflows from rural to urban East on the ASR was strongly negative across the entire period, the impact of the counterflow from urban to rural East was positive, although to a smaller degree, and therefore served to somewhat balance the negative impact of the outflow. Hence, our findings highlight the need for more nuanced analyses of the impact of migration on regional ASRs that distinguish outflows and inflows as well as different destination categories such as urban and rural.

The paper´s main limitation arises from the fact that migration flows for the period 1991–2001 are not available by sex. Accordingly, we can only speculate that in the decade after reunification East-West migration is likely to have had an even stronger negative impact on the ASRs in rural East Germany given the sizable East-West migration in the 1990s, while rural-urban migration within East Germany has likely been less relevant. However, research suggests that East-West migration in 1989 and 1990 was in fact dominated by males (Grundmann 1998), suggesting that the sex-selectivity of East-West migration changed in the early 1990s. Additionally, rural-urban migration within the East was already prevalent before reunification (Berentsen 1996; Kubis and Schneider 2007; Schmidt and Tittel 1990; Wendt 1994). Without gendered migration flow data, however, this puzzle cannot be fully solved.

Future research should further explore the heterogeneity of rural areas with regards to sex ratios and internal migration. The rural areas of East Germany include both the hinterland of the capital Berlin that benefits from recent suburbanization trends, as well as more remote counties in the historic mining belt that face a major transformation away from coal towards green energy. One can assume that ASRs and the impact of internal migration vary substantially between these regions. A promising trend is the growing attractiveness of East German cities that are characterized by high-quality institutions of higher education and comparatively affordable housing markets (Buch et al. 2013; Ganesch 2018). Their hinterland could profit from this development when the regions succeed in offering both male and female graduates a career perspective in the area.

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Appendix

Table A1. Female-to-male ratios, East and West Germany, persons aged 18–29 years

Year	Urban		Rural	
	East	West	East	West
1991	0.97	0.95	0.94	0.92
1992	0.94	0.94	0.91	0.91
1993	0.93	0.95	0.89	0.91
1994	0.91	0.95	0.88	0.91
1995	0.90	0.96	0.87	0.91
1996	0.89	0.96	0.86	0.91
1997	0.89	0.97	0.86	0.91
1998	0.90	0.97	0.86	0.91
1999	0.90	0.98	0.85	0.91
2000	0.91	0.98	0.85	0.91
2001	0.91	0.99	0.84	0.91
2002	0.92	0.99	0.84	0.91
2003	0.93	0.99	0.84	0.91
2004	0.94	1.00	0.84	0.91
2005	0.95	1.00	0.84	0.91
2006	0.95	1.00	0.84	0.91
2007	0.96	1.00	0.84	0.90
2008	0.96	1.00	0.84	0.90
2009	0.97	0.99	0.84	0.90
2010	0.98	0.99	0.85	0.90
2011	0.98	1.00	0.86	0.90
2012	0.98	0.99	0.86	0.90
2013	0.98	0.98	0.86	0.90
2014	0.97	0.97	0.87	0.89
2015	0.94	0.94	0.84	0.86
2016	0.94	0.93	0.85	0.87
2017	0.94	0.93	0.85	0.87
2018	0.94	0.93	0.86	0.87
2019	0.95	0.93	0.86	0.87
2020	0.96	0.94	0.86	0.88
2021	0.96	0.94	0.86	0.88

Data: Federal Statistical Office Germany and the Statistical Offices of the Länder, Spatial Monitoring of the BBSR, own calculations

Figure A1. Germany – BBSR county types