The Effect of Emigration on Wages: Evidence from Central and Eastern Europe

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Abstract: This paper estimates the short–run net effect of emigration on real gross monthly earnings in 10 Central and Eastern European countries by estimating a simple structural factor demand model. The model assumes that workers across education, workers within education and across age, and workers within education–age groups and across gender are imperfect substitutes. I find that the large emigration occurring due to EU accession increases average wages as much as 3.5%. In most countries, these gains are concentrated among young and highly educated female and male workers, while workers with an intermediate level of education see negligible wage gains or even losses. Finally, female workers exhibit higher wage gains than men, which indicates a possible decrease in the gender wage gap as a result of emigration.

Keywords: Migration, wage distribution, gender wage gap
JEL Classification: F22, J31, J61

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1 Introduction

In May 2004, the European Union (EU) opened its borders to 10 new countries—Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia—and 74 million people. Between 2003 and 2006, the stock of immigrants from new EU member countries increased by more than 1.1 million. Not only was it the largest EU expansion in terms of number of new countries and population, but it was also unique in that eight of the 10 new EU countries were former socialist countries with more economic challenges than most old EU member states. In 2003, the average unemployment rate across EU members was about 6.5%, while in the new EU countries it averaged about 10.5%. At 20%, Poland had the highest unemployment rate among new members. There was also considerable wage disparity between old and new members. In 2003, the average real hourly wages across old EU countries was 16.5 euros, while that average was 4.6 euros in new EU countries. The 2007 EU enlargement added Bulgaria and Romania with almost 29 million people and low hourly wages. These disparities fueled fears of mass migration from new EU to old EU countries and many debates about the adverse effects on the labor markets and social welfare systems in old EU countries. Questions concerning the effects of mass migration on the economic outcomes in sending countries were also raised. However, while there is an extensive literature on the effects of immigration on receiving countries, the effects of emigration on sending countries has been studied considerably less.

This paper asks the following: How does emigration affect wages in the sending country? How are the wage effects distributed across skill–gender groups? To answer these questions, I adopt a structural model of labor demand as in Borjas (2003) and Ottaviano and Peri (2012), and combine it with aggregated labor market and emigration data for 10 new EU member states (NMS). Using a four–level nested CES production technology, I estimate elasticities of substitution between female and male workers, across age groups and across different levels of education. Using these elasticities of substitution, I calculate factor price elasticities and the net wage effects of emigration. It is important to note a large benefit of using this model in estimating the wage effects of emigration: It allows estimating the overall wage effect of emigration as opposed to a partial effect.

Knowing the effects of emigration on wages in the sending country is important for several reasons. One, these effects can be indicative of the long–run health of the economy. Wages are a major factor in the decision to migrate, thus which way the changes go and how large the effects are can predict further increases in emigration, brain drain, return migration and foreign investment inflows. Two, in estimating the wage effects of emigration, I estimate elasticities of substitution which are crucial in how an economy absorbs labor supply shocks. For instance,

if young and old college–educated workers are easily substituted, then a large decrease in the labor supply of young college workers can significantly increase the wages of older college–educated workers. Three, knowing the substitutability between men and women is important in understanding how migration affects the gender wage gap, which persists in Central and Eastern European countries. Fourth, knowing how the wage effects of emigration are distributed across education, age and gender groups can help countries address income inequality. There is some evidence that rising income inequality is associated with lower economic growth, although this effect might be different across rich and poor countries and sometimes small and insignificant (Galor and Zeira (1993), Panizza (2002), Banerjee and Duflo (2003)).

The data come primarily from the EU Structure of Earnings Survey (SES) and Labor Force Survey (LFS). Aggregated SES and LFS data are provided by Eurostat, the European Commission Statistical Database. I complement labor market and population data from the SES and LFS with migration data from the OECD. The final sample contains earnings, labor force and emigration data on 10 countries over four years, three education levels, four age groups and across gender, for a total of 960 observations.

Using the pooled sample of 10 countries, I find elasticities of substitution that are broadly in line with the existing literature. I find that workers with different levels of education have an elasticity of substitution of 1.95, which indicates a low degree of substitution across education groups. The elasticity of substitution within education group and across age groups is slightly higher at 2.25. These estimates are within the ranges found in other studies (Katz and Murphy (1992), Card and Lemieux (2001), Borjas (2003), Ciccone and Peri (2005) , Manacorda, Manning, and Wadsworth (2012), Ottaviano and Peri (2012), and Elsner (2013b)). The elasticity of substitution between women and men is estimated at 6. Women and men are imperfect substitutes, but are relatively more substitutable then workers in different age or education groups. There are fewer papers investigating the degree of substitutability between women and men, but this elasticity is within the range found in those studies (Acemoglu, Autor, and Lyle (2004) finds an elasticity of 3, de Giorgi, Paccagnella, and Pellizzari (2015) an elasticity of 1–1.4, Freire (2011) an elasticity of 1.8, while Edo and Toubal (2017) reports an elasticity between 12–14). An important detail is that these elasticities vary across countries, and some countries have estimates that do not align with the CES framework assumptions.

The estimated net wage effects follow the predictions of a standard supply and demand model: Emigration decreases labor supply and increases wages. While magnitudes vary across countries, I find that relatively young college educated working men and women experienced the largest gains from emigration in terms of real wage increases. Average wage increases for college educated workers range from 0.42% in Estonia to 4.4% in Slovakia. Low educated workers—those with less than a high school diploma—saw wage decrease in Slovenia and

increases of about 4.2% in Romania. Workers at intermediate levels of education—high school graduates or those with some college—saw close to no wage increases because of emigration. These results echo both those of Borjas (2003) and Elsner (2013b), but are contrary to those found in Docquier, Ozden, and Peri (2013).

When considering the estimated wage changes in this study, it is crucial to keep in mind that these are short–run effects. An extensive literature on the welfare gains of migration concentrates on the effects of immigration on receiving countries, receiving country wages and gains to immigrants (Hamilton and Whalley (1984), Borjas (1995), Aydemir and Borjas (2007), Klein and Ventura (2009), Dustmann, Frattini, and Preston (2013), Kennan (2013), Kennan (2017), Hendricks and Schoellman (2017)). A smaller literature explores channels through which emigration affects the sending country long–term. In the long–run, emigration might prompt "brain gain"' and innovation through return migration or increase in human capital in anticipation of higher returns abroad (Mountford (1997), Beine, Docquier, and Rapoport (2001), Dustmann, Fadlon, and Weiss (2011), Mayr and Peri (2009), Docquier and Rapoport (2012), Dinkelman and Mariotti (2016)). While theoretical models of positive long–run effects of migration have been considered, the potential negative effects of migration are hardly studied. Giesing and Laurentsyeva (2017) uses the gradual opening of EU labor markets to NMS migrants to estimate the effect of emigration on firm productivity. Their study finds that firms in NMS countries are negatively affected. There are several explanations for these results. If high skill workers leave faster than high skill workers are produced, human capital in the sending country depletes. This brain drain can lead to drops in productivity as firms lose their "brains" and cannot fill vacancies. The effect of emigration could be exacerbated if firms face significant adjustment costs or need to train new workers. Since wages reflect productivity, they would decrease as well, prompting more people to emigrate in search of better jobs and higher standards of living. Thus, emigration can affect long–term innovation and growth, the availability and stability of social welfare, health insurance and pension systems. This study assumes constant labor demand and capital stock, and merely estimates the effects of emigration within two to three years of EU accession.

This paper makes several contributions. One, it uses a structural factor demand model and estimates the net effect of emigration on wages as opposed to a partial effect. Mishra (2007) led the literature on emigration using Mexico as the sending country and the US as the receiving country. Using OLS and IV estimation and the skill–experience identification strategy proposed by Borjas (2003), it found that a 10% decrease in the labor force due to emigration causes a 4% increase in wages. Elsner (2013a) follows the empirical framework of Borjas (2003) and Mishra (2007) using Lithuanian household data and UK and Irish work permit and census data. It finds that a 10-percentage point increase in the emigration rate increases wages by almost

7%. Dustmann, Frattini, and Rosso (2015) uses Polish micro–level data and regional variation in emigration in an OLS and IV estimation, and finds that a 10% increase in the emigration rate increases net wages by 10%. Breaking it down by skill level, it finds that intermediate and high skill workers see increases of about 14%, while low skill wages drop by 2%. In addition to finding the partial effect of emigration on wage group, I use a structural factor demand model and find that emigration increased wages between a negligible 0.02% to 4.4%. To the best of my knowledge, Elsner (2013b) is the only other paper using a similar structural model to estimate the wage effects of emigration.

Two, this paper estimates elasticities of substitution and wage effects of emigration for a panel of 10 countries. Again, Elsner (2013b) estimates the net wage effects of emigration in the case of Lithuania and assumes external validity since most NMS countries were part of the Eastern Block. I show that both the elasticities of substitution and wage effects are different across countries. Moreover, I am not aware of another paper that estimates the elasticities of substitution across education, age and gender for Central and Eastern European countries.

Three, this paper is related to the gender wage gap literature. I extend the three–level nested CES structure to include gender and estimate the degree of substitution between men and women. There is a growing literature on gender complementarities in the workplace. Dezső and Ross (2012) use panel data on top management teams of S&P 1,500 companies and find that having women in top management improves firm performance. Ellison and Mullin (2014) uses anonymous employee satisfaction surveys provided by a professional services firm with over sixty international offices to find equal or worse performance of gender–homogeneous offices compared to mixed offices. While these papers look at gender complementarity for highly skilled workers, their results lend credibility to considering men and women as substitutes in production. As noted above, other papers that estimate the elasticity of substitution across genders do so for a handful of countries (Acemoglu, Autor, and Lyle (2004), de Giorgi, Paccagnella, and Pellizzari (2015), Freire (2011), Edo and Toubal (2017)). Edo and Toubal (2017) estimate the wage effect of immigration on women and find that immigration decreases native wages of women relative to men, thus increasing the gender wage gap. The results in this study show a low degree of substitutability between men and women, and higher gains from emigration to women relative to men. These results imply that emigration reduces the gender wage gap. To my knowledge, this is the first paper that looks at the effects of emigration on the gender wage gap.

The rest of the paper is organized as follows. Section 2 presents the structural model. Section 3 describes the data and presents summary statistics. Section 4 outlines the empirical implementation and results. Section 5 addresses concerns about selection of emigrants. Section 5 discuss the estimation results. Section 6 concludes.

2 The Model

To estimate the overall effect of emigration on wages, I develop a structural model of labor supply and demand following Borjas (2003) and Ottaviano and Peri (2012). The model extends the three–level CES production technology specified in Borjas (2003) to include a fourth nest that separates workers by gender. In equilibrium, wages equal marginal productivity and are affected by both the labor supply shock to one's own group and by the labor supply shocks to other groups. Using this framework, I estimate the elasticities of substitution between workers belonging to different groups, then use those elasticities to calculate the net wage effect of emigration. In what follows, I omit country subscripts to avoid clutter, but all equations are estimated using country–level data.

2.1 Production Technology

Aggregate production at time t is characterized by a nested CES technology using capital K_t and labor L_t used to produce output Q_t. L_t is composed of education-specific labor L_{it}, L_{it} is composed of age–specific labor L_{ijt}, and L_{ijt} is composed of gender–specific labor L_{ijkt}. The aggregate production function at time t is

$$Q_t = [\lambda_t L_t^{\nu} + (1-\lambda_t)K_t^{\nu}]^{\frac{1}{\nu}} \tag{1}$$

where λ is a time–variant relative productivity of the labor aggregate and $\sigma_{KL} = \frac{1}{1-\nu}$ is the elasticity of substitution between capital and labor, with $\nu \in (-\infty, 1]$. One nest down, the labor aggregate is composed of workers with different levels of education:

$$L_t = \left[\sum_i \theta_{it} L_{it}^{\rho}\right]^{\frac{1}{\rho}} \tag{2}$$

where θ_{it} is a time–varying parameter for the contribution of labor with education level i to the output of the labor aggregate, with $\sum_i \theta_{it} = 1$. This allows workers with a particular level of education to become relatively more productive over time. $\sigma_{EDU} = \frac{1}{1-\rho}$ is the elasticity of substitution between education groups, with $\rho \in (-\infty, 1]$. At this stage, workers with the same level of education but different age or gender are perfect substitutes. The supply of workers within an education group is given by

$$L_{it} = \left[\sum_j \gamma_{ij} L_{ijt}^{\eta}\right]^{\frac{1}{\eta}} \tag{3}$$

where γ_{ij} is a time–invariant relative productivity of workers with education i and age j, with $\sum_j \gamma_{ij} = 1$. It represents the contribution of workers in group ij to the output of workers with education i. The fact that it is time–invariant means that, within each education group, the relative contributions of workers in different age groups are stable over time. This assumption is needed in identifying the elasticity of substitution across age groups. $\sigma_{AGE} = \frac{1}{1-\eta}$ is the elasticity of substitution across age groups within the same education group, with $\eta \in (-\infty, 1]$. Within each education group, workers in the same age group are perfect substitutes, regardless of gender. Finally, L_{ijt} is composed of working men and women:

$$L_{ijt} = \left[\sum_k \mu_{ikt} L_{ijkt}^{\phi} \right]^{\frac{1}{\phi}} \tag{4}$$

where μ_{ikt} is a time–variant relative productivity of workers with gender k within education group and time period it, with $\sum_k \mu_{ikt} = 1$. I assume that the relative productivity of women within education groups and time is the same across age in order to identify the effect of a shock to L_{ijkt} on w_{ijkt}. $\sigma_{SEX} = \frac{1}{1-\phi}$ is the elasticity of substitution across gender within an education–age group, with $\phi \in (-\infty, 1]$. Workers with the same education–age–gender characteristics are perfect substitutes.

Assuming competitive labor markets, the wage of each group equals its marginal product:

$$\begin{aligned} \log w_{ijkt} = \log \lambda_t + (1-\nu)\log Q_t + (\nu-\rho)\log L_t + \log \theta_{it} + (\rho-\eta)\log L_{it} + \\ \log \gamma_{ij} + (\eta-\phi)\log L_{ijt} + \log \mu_{ikt} + (\phi-1)\log L_{ijkt} \end{aligned} \tag{5}$$

Letting δ_x denote x–specific fixed effects, Equation (5) can be expressed as

$$\log w_{ijkt} = \delta_t + \delta_{it} + \delta_{ij} + \delta_{ijt} + \delta_{ikt} + \beta_{sex} \log L_{ijkt} \tag{6}$$

where $\beta_{sex} = \phi - 1 = -\frac{1}{\sigma_{SEX}}$ is the coefficient of interest. $\delta_t = \log \lambda_t + (1-\nu)\log Q_t + (\nu-\rho)\log L_t$ is a time–fixed effect, $\delta_{it} = \log \theta_{it} + (\rho-\eta)\log L_{it}$ is a time–education fixed effect, $\delta_{ij} = \log \gamma_{ij}$ is a education–age fixed effect, $\delta_{ijt} = (\eta-\phi)\log L_{ijt}$ is a education–age–time fixed effect and $\delta_{ikt} = \log \mu_{ikt}$ is a education–gender–time fixed effect.

To estimate the elasticity of substitution across age groups, I calculate a weighted average

wage and aggregate workers over gender, and estimate the following equation:[1]

$$\log w_{ijt} = \delta_t + \delta_{it} + \delta_{ij} + \beta_{age} \log L_{ijt} \tag{7}$$

where $\beta_{age} = \eta - 1 = -\frac{1}{\sigma_{AGE}}$ is the coefficient of interest, and the fixed effects are defined as in Equation (5).

Finally, to get the elasticity of substitution between education groups, I use the log of weighted average wages and number of workers by education group in the following specification:

$$\log w_{it} = \delta_t + \log \theta_{it} + \beta_{edu} \log L_{it} \tag{8}$$

where $\beta_{edu} = \rho - 1 = -\frac{1}{\sigma_{EDU}}$. To identify β_{edu}, I approximate $\log \theta_{it}$ with an interaction of education fixed effects and a linear time trend.

The elasticity of substitution between labor and capital $\sigma_{KL} = \frac{1}{1-\nu}$ can be calculated using the following equation:

$$\log w_t = \log \lambda_t + (1-\nu) \log Q_t + \beta_{KL} \log L_t \tag{9}$$

Estimating Equation (9) is difficult in practice because β_{KL} cannot be identified in the presence of time fixed effects. Instead of estimating Equation (9), I assume a Cobb–Douglas production function and set σ_{KL} equal to 1.

The model above is somewhat different from the standard estimation of an elasticity of substitution. Katz and Murphy (1992) estimate the elasticity of substitution between college and high school graduates using relative wages and relative labor supplies instead of levels. Writing the model in terms of relative wages and labor supplies allows the elasticities of substitution to vary across different groups. For instance, one could separately calculate the elasticity of substitution between college graduates and high school graduates and the elasticity of substitution between college graduates and high school dropouts. Instead, this specification of the model reduces the number of calculations by assuming that high school dropouts and college graduates are as substitutable as high school graduates and college graduates. Similarly, within education groups, young and middle–aged workers are as substitutable as young and old workers. In addition, the substitutability across age is assumed constant across education groups. In other words, young and old college graduates are as substitutable as young and

[1] Alternatively, I use Equation (4) and $\mu_{ikt} = \frac{\exp \delta_{ikt}}{1+\sum_k \exp \delta_{ikt}}$ to calculate L_{ijt}. Borjas (2003) uses both the CES–weighted labor aggregate and the number of workers in the data for education groups and finds that the estimated elasticities of substitution are very similar.

old high school dropouts. With 30 education–age–gender groups, these assumptions reduce the number of elasticities from 435 to three (excluding σ_{KL}). A model in levels is also used by other papers, including Borjas (2003) and Ottaviano and Peri (2012), as well as Card and Lemieux (2001), thus I can easily compare my results with other studies.

3 Data and Descriptive Statistics

To calculate wage changes due to emigration for each education–age–gender group, I collect data from Eurostat, the OECD, the UN and national statistical offices on 10 new EU member countries. These 10 countries are Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. Bulgaria and Romania entered the EU in 2007, while the other countries entered in 2004.[2] The data set contains country–year–education–age–gender level real gross monthly wages, the number of employees and emigration rates for 2002, 2006, 2010 and 2014, five age groups—less than 30 years old, 30–39 years old, 40–49 years old, 50–59 years old and above 60 years old—and three education levels—high (tertiary), intermediate (upper secondary) and low (lower secondary, primary and no education).[3] The main dependent variable is log of real gross monthly wage, and the explanatory variable is log number of workers instrumented by log emigration rate. It is important to note that not all data is available at the education–age–gender level, thus several assumptions are made in constructing the final data set.

3.1 Number of Employees

The main data sources for earnings statistics are the EU Structure of Earnings Survey (SES) and the EU Labor Force Survey (LFS), both conducted by all EU member states. The SES is a representative enterprise survey conducted every four years and offers harmonized data on earnings, number of employees, firm and employee characteristics. The survey covers all industries except public administration, defense, agriculture, forestry and fishing, and is available for 2002, 2006, 2010 and 2014. The LFS is a quarterly representative household survey offering harmonized data on labor participation of people aged 15 and above. It is available since 1983 and covers all industries. Eurostat provides aggregated SES and LFS data grouped by combinations of age, gender, education, occupation and other characteristics, but not always at the education–age–gender level. The SES offers average gross monthly earnings and num-

[2] I omit Cyprus and Malta from the analysis as these two countries are small, were not subject to any labor movement restrictions and have missing data.

[3] The intermediate level of education is equivalent to having a high school diploma or some college, while low education includes high school dropouts and those with less education.

ber of employees by gender, age group and occupation for 2006, 2010 and 2014. To obtain the number of employees for 2002, I use LFS data on the number of employees by gender, age group and occupation for 2002 and assume that the LFS and the SES have similar distributions in 2002 as in 2006, 2010 and 2014. The ratios of LFS to SES employees in each cell are stable across cells and years within each country, which implies that the distributions are similar. I use the average of the 2006, 2010 and 2014 ratios and apply it to the LFS data in 2002 to obtain data on number of employees by gender, age groups and occupations that is comparable to SES data in other years.

Next, to obtain the number of workers by gender, age and education from the SES data, I use LFS data on the number of employed people (both employees and self-employed) by gender–education–occupation. I assume that within occupation and gender, the educational distribution of employees is the same across age groups. For example, this second assumption says that young and old male sales workers have the same percentage of high and low educated workers. While the educational requirements for sales workers may have remained the same over time, this assumption could be problematic in the case of managers or professionals. As this assumption is crucial in constructing the data and I cannot further test it without micro–level data, I proceed by assuming it is true. Using these assumptions, I calculate the educational breakdown of employed people within each gender and occupation group, then apply this breakdown to the SES data on number of employees by gender, age group and occupation. The resulting data set contains the number of employees at the education–age–gender–occupation level for each country in 2002, 2006, 2010 and 2014.

3.2 Earnings

Gross monthly wages by gender, age group and occupation are available from the SES. Using wage premia and the number of workers by education–age–gender–occupation described in Section 3.1, I calculate wages at the education–age–gender level using the following equation:

$$w_{jkO} = \frac{w_{1,jkO} L_{i,jkO} + \sum_{i=2}^{n} w_{1,jkO} Premium_{i,jkO} L_{i,jkO}}{\sum_{s=1}^{n} L_{s,jkO}} \tag{10}$$

where i, j, k and O denote level of education, age group, gender and occupation, respectively; w_{jkO} and L_{ijkO} are the average wage of group jkO available from SES and the number of employees of group $ijkO$. $Premium_{ijkO}$ is the wage premium that workers of education level i in group jkO receive relative to workers of education level 1 and in group jkO. A rearrangement of Equation (10) gives the wage of education level 1 workers.

Eurostat reports SES earnings data by education and gender. This allows me to calculate the wage premia for each country by gender, but not by age. To assume that the wage premia are the same across age groups would mean to assume that the age–earnings profiles for different education groups are vertical shifts of one another. Using data from the World Bank, de Hoyos, Kennan, and Lessem (2017) show that this assumption is false. Unfortunately, I could not find age–earnings profile data for all countries and years covered in my sample, except for the Czech Republic. The Czech Statistical Office publishes average gross monthly earnings by age and education groups for various years. I therefore combine these Czech data with the wage premia calculated from the SES to obtain wage premia by age and gender using the following steps:

Step 1. Calculate weighted average wage premium over age groups for each pair of education levels using Czech age–earnings profiles.

Step 2. For all education pairs, calculate the ratio of the average wage premium to the wage premium of each age group.

Step 3. Apply the ratio from step 2 to the average wage premia by gender calculated using SES data.

Two assumptions are implied by these steps: (1) Age–earnings profiles in the Czech Republic are similar to age–earnings profiles in all other countries in the sample; and (2) the ratios of average to age–specific wage premia are the same for women and men. The former assumption is supported to some extent based on figures from de Hoyos, Kennan, and Lessem (2017). These figures reveal that the age–earnings profiles for Estonia, Latvia and Slovakia are similar to each other, while Slovenia follows a different pattern. Furthermore, the general shape of the age–earnings profiles look similar for men and women up to about age 40. If the distribution of the number of workers over age is similar between men and women, this last observation could lend some validity to the latter assumption.

Finally, I deflate gross monthly earnings by CPI with 2002 as base year and calculate weighted average wages over occupation. The resulting data set contains real gross monthly earnings by country–year–education–age–gender in 2002 euros. Table 1 presents changes in real wages around EU accession by gender, age and education for the pooled sample of 10 countries. The youngest workers saw the largest wage increases, with relatively young women and the oldest wome gaining more than the young men and oldest men, respectively. Table A1 in the appendix reports wage gains (or losses) by country. In most countries, younger workers saw larger wage increases, and young and highly educated women saw larger gains than their male counterparts.

Table 1. Average Real Wage Changes around EU Accession

	(1)	(2)	(3)	(4)	(5)	(6)
	Women			Men		
Age	Low	Mid	High	Low	Mid	High
<30	22.43	23.24	21.56	19.64	18.92	15.96
30-39	8.52	14.91	14.78	5.71	13.84	11.07
40-49	11.73	10.09	12.21	11.43	14.04	15.31
50-59	13.93	9.89	10.41	12.91	13.62	9.99
60+	21.48	18.78	23.14	17.55	14.88	16.81

Notes: Pooled sample weighted average wage changes are calculated as the percentage change between pre and post–EU wages calculated using Equation (10), where the years considered are 2002 and 2006 for 2004 entrants, and 2006 and 2010 for 2007 entrants. The averages are weighted by the number of employees for each country and cell. The pooled sample includes Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

3.3 Emigration

To estimate the effect of emigration on wages, it would be ideal to have detailed micro–level emigration data from the source country. The EU LFS contains detailed household level information, including nationality and years of residence in the country. However, nationality is aggregated in country groups and is available from 2004 onward, while years of residence is available from 2008 onwards and is grouped in five–year bands. National labor force surveys also exist for some countries, but I am not aware whether survey data across countries is comparable or whether they collect data on emigrants. Existing literature either does not use emigration data (Giesing and Laurentsyeva (2017)) or retrieves it from immigration data collected through censuses and labor force surveys in receiving countries. Emigration rates calculated using emigration data might be different from the emigration rates calculated using receiving country immigration data. They differ because NMS nationals that live and work in an old EU country are recorded as immigrants in the receiving country, but aren't necessarily recorded as emigrants in their home country. Thus, immigration data collected by receiving countries is a better proxy for the true emigration rate in new EU countries. Data on immigrant population measured in the receiving country is more consistently available. It is also richer in terms of breakdowns by age, education, gender and citizenship. Therefore, I use immigrant population as measured in the receiving country to calculate emigration rates.

Emigration statistics come from Eurostat and the OECD's Database on Immigrants in OECD countries (DIOC), as well as national statistics offices and UN international migration statistics. Eurostat provides immigrant population time series data by citizenship, age group and gender for each EU country. The DIOC database also provides immigrant population data by citizenship for all OECD countries, broken down by level of education, age and gender. For each receiving–sending country pair and each age–gender cell, I use the DIOC data to calculate the educational breakdown of emigrants, where education groups are defined as in the SES

data. Unlike the Eurostat data, the DIOC data is only available for 2000/2001, 2005/2006 and 2010/2011. I therefore assume that the distributions of immigrants in 2002 and 2014 are the same as those in 2000/2001 and 2010/2011, respectively. I then apply these educational breakdowns to the corresponding receiving country–sending country–age–gender cells in the Eurostat data to obtain immigrant population by education–age–gender for each receiving–sending country pair. The number of immigrants is then summed over all receiving countries, resulting in a data set containing the number of emigrants at the education–age–gender level for each country and for 2002, 2006, 2010 and 2014.

Working age population by education, age and gender is available from Eurostat LFS. I proxy the labor supply shock occuring due to EU accession with the emigrant share of the population, defined as

$$p_{ijkt} = \frac{M_{ijkt}}{M_{ijkt} + N_{ijkt}} \tag{11}$$

where M_{ijkt} and N_{ijkt} are the stock of emigrants and the working–age domestic population in group ijk at time t, respectively.

In calculating the effects of emigration on wages, I use country–specific emigration rates defined as

$$m_{ijk} = \frac{M_{ijk}^{post-EU} - M_{ijk}^{pre-EU}}{N_{ijk}^{pre-EU}} \tag{12}$$

where *pre–EU* and *post–EU* indicate the nearest year before and after EU accession available in the SES. For Bulgaria and Romania, these years are 2006 and 2010, respectively. For all other countries, these years are 2002 and 2006, respectively. The numerator reflects the number of people in group ijk that have left the country after EU accession.[4]

Table 2 reports weighted average emigration rates calculated using Equation (12) for each country. Many groups experienced large outflows. These outflows are most notable among relatively young workers with high and low levels of education. For instance, the stock of young and highly educated female migrants increased by 7–9% and the emigrant stock of low educated men in their 30s increased by 12%. Table A2 in the appendix reports emigration rates by country. While there is some heterogeneity in the magnitudes across countries, the emigration patterns are very similar. I use these sudden outflows as shocks to domestic labor supply. In effect, EU accession allows me to identify the slope of the labor demand by using

[4]Instead of native working–age population N_{ijk}, Elsner (2013b) uses the labor force. Since not all emigrants were employed before migration, it is more appropriate to compare the change in emigrant stock to the entire population from which these emigrants were drawn.

emigration as a supply shifter.

Table 2. Average Emigration Rates around EU Accession

	(1)	(2)	(3)	(4)	(5)	(6)
	Women			Men		
Age	Low	Mid	High	Low	Mid	High
<30	2.13	1.90	6.80	2.90	2.33	7.67
30-39	8.81	3.19	8.98	12.03	3.76	8.20
40-49	7.30	3.43	4.80	7.86	2.76	4.42
50-59	1.86	1.82	2.77	2.03	1.18	2.93
60+	0.19	0.42	0.91	0.18	0.28	0.59

Notes: Pooled sample weighted average emigration rates are calculated using Equation (12), where the pre and post–EU accession years considered are 2002 and 2006 for 2004 entrants, and 2006 and 2010 for 2007 entrants. The pooled sample includes Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

The final sample is a panel of 10 countries over four years, three education groups, five agre groups across gender for a total of 1,200 observations. For the main analysis, I exclude workers above 60 years old as the number of emigrants and number of workers in this age group are small and I worry there might be a large margin of error. The final sample for the four main groups is 960 observations.

3.4 Descriptive statistics

Table 3 presents summary statistics for non–emigrants workers and emigrants, by year. NMS8 in panel A refers to the eight countries that entered the EU in 2004 and NMS2 in panel B refers to countries that entered the EU in 2007 (Bulgaria and Romania). Columns (1)–(4) present aggregated statistics on non–emigrants in the labor force, while columns (5)–(8) present statistics on emigrants. Columns (1) and (5) show the percentage of workers and of emigrants with high education, respectively. Columns (2), (3), (6) and (7) are defined similarly. In NMS2 countries, non–emigrant workers are relatively more educated than emigrants, while emigrants are relatively younger and female.[5] In NMS8 countries, emigrants are relatively more educated, younger and female. Column (4) shows the weighted average real gross monthly earnings for each group of countries. Both groups show the highest percentage increase in earnings around the year of EU accessions: earnings grow by almost 14.5% between 2006 and 2010 in NMS2, and by about 17% between 2002 and 2006 in NMS8 countries.[6] Finally, column (8) shows the number of emigrants relative to the domestic population plus the stock of emigrants for each country group. Similarly to wages, the emigrant share increases the most around EU accession, and more so for NMS2 than for NMS8.

[5] Young workers are workers below 40 years old.

[6] Table A3 and Table A4 in the appendix reproduce these statistics by country and by gender.

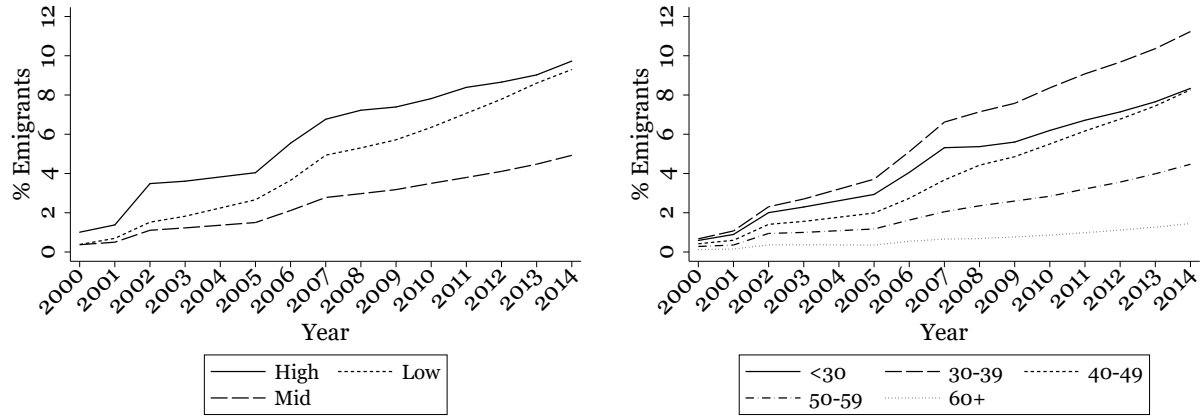
Table 3. Descriptive Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Non-emigrants				Emigrants			
Year	% High	% Young	% Female	Average wage	% High	% Young	% Female	Emigrant share
				Panel A: NMS8				
2002	19.54	49.42	48.12	505.34	28.98	65.61	54.42	1.49
2006	24.66	49.02	47.97	592.17	34.23	68.58	52.26	2.64
2010	29.23	49.22	48.45	636.52	38.33	68.35	52.53	4.04
2014	32.91	47.78	48.66	655.57	39.08	66.29	50.49	6.17
				Panel B: NMS2				
2002	20.63	51.25	47.61	177.12	18.85	78.03	49.28	2.31
2006	19.91	50.40	48.24	195.60	15.60	79.60	52.35	5.61
2010	27.70	46.57	49.04	224.11	16.48	70.31	51.40	10.30
2014	29.03	44.93	48.70	240.25	18.59	65.00	51.62	13.27

Notes: Panel A reports statistics for the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. Panel B reports statistics for Bulgaria and Romania.Columns (1)–(4) report summary statistics for working non–emigrants. Columns (5)–(8) reports statistics on emigrants. Columns (1)–(3) report the percentages of working non–emigrants that are highly educated, young and female, respectively. Columns (5)–(7) are defined analogously for emigrants. Column (4) reports real gross monthly wages (at 2002 euros) for domestic workers. Column (8) reports the number of emigrants relative to the domestic population plus the stock of emigrants in a given year.

Figure 1 shows the emigrant share by education and by age in the pooled sample, as described in Equation (11). The share of highly educated emigrants is much higher than the share of those with less than college education. Similarly, the shares of young emigrants—those younger than 40—are higher than the share of older emigrants. These shares—both by education and by age groups—increase over time and most notably around EU accession, but at different rates. For instance, the share of emigrants with intermediate level of education remained stable between 2002 and 2006, while that of high and low–educated emigrants increased. If low–educated workers become more scarce in sending countries relative to mid–educated workers, their wages would increase relative to the wages of the mid–educated workers. By 2014, over 10% of the domestic highly educated and relatively young population lives outside the sending country. Figure 1 in the appendix reveals that the emigrant shares rose dramatically and reach 20% in some countries. Given the patterns by age groups presented in Table 2 and Figure 1, one should also expect to see wages of younger workers to increase relative to those of older workers. Overall, the summary statistics point to large migration outflows, in particular among young and highly educated workers, which motivates the question of how such outflows have affected earnings of those who stayed.

Figure 1. Emigrants as % of working age population (native plus emigrants)



Notes: The figure shows the emigrant share broken down by education (left panel) and by age (right panel). Emigrant shares are calculated according to Equation (11). The stock of emigrants is proxied by the stock of immigrants as measured by receiving countries. Data for 2004 is ommitted as there is missing information on several receiving countries. Data come from the EU Labor Force Survey and the OECD DIOC.

4 Empirical Implementation and Results

4.1 Estimating Elasticities of Substitution

In estimating the effect of emigration on wages, I first calculate the elasticities of substitution across gender within education–age group, across age groups within education group, and across education groups. Empirically, these three elasticities are calculated by estimating Equations (6)–(8) by 2SLS using the log of foreign emigrant share as an instrument for log labor supply. I repeat the equations for convenience:

$$\log w_{ijkt} = \delta_t + \delta_{it} + \delta_{ij} + \delta_{ijt} + \delta_{ikt} + \beta_{sex} \log L_{ijkt} + \epsilon_{ijkt}$$
$$\log w_{ijt} = \delta_t + \delta_{it} + \delta_{ij} + \beta_{age} \log L_{ijt} + \epsilon_{ijt}$$
$$\log w_{it} = \delta_t + \log \theta_{it} + \beta_{edu} \log L_{it} + \epsilon_{it}$$

One issue with estimating elasticities of substitution is endogeneity of labor supply. To overcome this problem, the immigration literature has used the share of immigrants within each skill group to proxy for a shift in the labor supply curve while leaving the labor demand curve unchanged. In the case of emigration, one can use the share of emigrants (i.e. the number of emigrants relative to the sum of domestic workers and emigrants in each group) to proxy for shocks to labor supply in the sending country. However, emigration decisions are also dependent on wages, thus the endogeneity issue persists. An alternative labor supply shifter considered by Elsner (2013b) is the emigration rate of nearby countries that also entered the

EU at the same time. In estimating the elasticities of substitution for Lithuania, Elsner (2013b) uses emigration from Poland and Latvia as proxy for Lithuanian labor supply shifts. The idea is that all three countries entered the EU at the same time and experienced similar emigration patterns, thus Polish and Latvian emigration rates are correlated with Lithuanian emigration rates, and therefore with Lithuanian labor supply.

In addition to relevance, a valid instrument is uncorrelated with the error term. For example, this amounts to assuming that Polish and Latvian emigration rates are uncorrelated with any omitted variables affecting Lithuanian wages. This is a reasonable assumption, as Polish and Latvian emigrants moved predominantly to old EU countries and it is unlikely that Lithuanian wages were a factor in the decision of Poles and Latvians to migrate. I follow this approach and instrument labor supply in each country with emigrant shares of another NMS country. Instead of proximity, I pair countries based on highest correlation of emigrant shares, where emigrant shares are defined as in Equation (11).[7]

Table 4 shows the first stage coefficients and IV estimates of the elasticity of substitution between men and women for the entire sample of 10 countries and for different specifications. Columnn (1) does not inlcude country–specific fixed effects and reports robust standard errors. Column (2) adds country fixed effects to control for any time–invariant country–specific characteristics that might affect wages for each ijk group. Column (3) includes both country and country–year effects, as well as clustered standard errors at the country–education–age level. The country–time effects capture any characteristics—different accession years, investment flowing into the country—that affects wages of all skill–gender groups similarly. Columns (4)–(7) include country fixed effects and clustered standard errors at the country–education–age level. Column (4) is the preferred specification for the pooled sample, column (5) adds the oldest cohort to the analysis, while columns (6) and (7) split the sample into NMS8 and NMS2 countries. All first–stage coefficients are negative and significant and the F–statistic is above 10, except for column (7) which restricts the analysis to Bulgaria and Romania. Overall, the log of foreign emigration share is a relevant instrument.

All specifications show that men and women are imperfect substitutes and in most cases the elasticity is precisely estimated. In the baseline specification, the elasticity is 6, and the result is robust to including the oldest cohort or restricting the sample to NMS8 countries. When including country–year effects (column (3)), the elasticity increases to 11, indicating greater degree of substitutability between men and women, while restricting the sample to NMS2 countries reduces it to 2. In comparison, Edo and Toubal (2017) find an elasticity of

[7]Alternatively, I use an indicator that equals 1 in years after EU accession, and 0 otherwise. I also use a third instrument that equals a foreign country emigrant share in years after EU accession and 0 otherwise. Both instruments are relatively weak.

Table 4. Elasticities of Substitution across Gender

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Pooled	Country FE	CT	Baseline	With old	NMS8	NMS2
Labor supply	−1.76***	−0.17***	−0.09***	−0.17**	−0.15***	−0.20***	−0.51
	(0.50)	(0.05)	(0.02)	(0.07)	(0.04)	(0.07)	(0.56)
σ_{SEX}	0.57	6.01	11.10	6.01	6.51	5.04	1.98
First stage	0.16***	−0.24***	−0.33***	−0.24***	−0.35***	−0.25***	−0.16
	(0.05)	(0.04)	(0.04)	(0.06)	(0.07)	(0.06)	(0.17)
F-stat	[10.3]	[44.0]	[79.3]	[16.2]	[23.9]	[16.5]	[0.9]
Country FE	N	Y	Y	Y	Y	Y	Y
Country-year	N	N	Y	N	N	N	N
Clustered SE	N	N	Y	Y	Y	Y	Y
Adj. R^2	.	0.95	0.97	0.95	0.95	0.92	0.90
Obs.	949	949	949	949	1,188	757	192

Notes: This table presents IV estimates of Equation (6) and first–stage results. Foreign emigration rates are used as instruments for domestic labor supply. Column (1) presents estimates for the pooled sample without country–specific countrols and robust standard errors. Column (2) adds country fixed effects. Column (3) adds country and country–year effects. Columns (4)–(7) include country fixed effects and clustered standard errors by country–education–age. Column (4) is the baseline regression for the pooled sample. Column (5) includes the oldest cohort (age 60+). Columns (6) and (7) present estimates for countries entering the EU in 2004 and 2007, respectively. ***,**,* indicate statistical significance at a 1, 5, and 10 percent levels, respectively.

substitution between 12 and 14 using French data. On the other hand, de Giorgi, Paccagnella, and Pellizzari (2015) find an elasticity of substitution of about 1.4 using Italian data, while Acemoglu, Autor, and Lyle (2004) find an elasticity of 3 using U.S. data. Thus, my estimate falls within the range estimated in other studies.

The results in Table 4 restrict the elasticity of substitution between women and men to be the same across education and age groups. Table A5 relaxes this assumption for the pooled, NMS8 and NMS2 sample. Panel A shows that the elasticities for each education group are mostly out of line with the CES production function framework. Panel B shows heterogeneity in substitution across age groups. In the pooled sample, women and men are most substitutable in their 30s and least substitutable in their 20s, but the estimates are not precise. The results imply that there are different production technologies combining men and women for different age groups.

Table 5 reports estimates of Equation (7). The specifications are similar to those in Table 4, with the addition of female and male–only sample in columns (4) and (5). All specifications include country fixed effects and cluster standard errors at the country–education–age level. The first–stage coefficients are negative and mostly statistically significant, but the instrument strength varies across specifications. The baseline estimate is −0.44 and is statistically significant, implying that a 10% increase in the labor supply of an age group relative to other age groups decreases the wage of that age group by 4.4%, relative to the wages of other age groups. The elasticity of substitution across age is 2.25, implying a lower substitutability across age groups than across men and women. These results are robust to using labor composites constructed with the estimated coefficients, or using $\hat{\delta}_{ijt}$ as a dependent variable (see columns

Table 5. Elasticities of Substitution across Age Groups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Baseline	CT	With old	Women	Men	NMS8	NMS2
Labor supply	−0.44**	−0.30***	−0.32***	−0.06	−0.59	−0.54**	2.09
	(0.20)	(0.10)	(0.08)	(0.07)	(0.37)	(0.25)	(14.60)
σ_{AGE}	2.25	3.30	3.15	16.44	1.70	1.84	−0.48
First stage	−0.15**	−0.23***	−0.28***	−0.24***	−0.11*	−0.15**	−0.02
	(0.06)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.17)
F-stat	[5.9]	[11.0]	[14.8]	[11.3]	[3.1]	[5.1]	[0.0]
Adj. R^2	0.90	0.95	0.91	0.96	0.85	0.79	.
Obs.	480	480	600	471	478	384	96

Notes: This table presents IV estimates of Equation (7) and first–stage results. Foreign emigration rates are used as instruments for domestic labor supply. All specifications include country–specific fixed effects and standard errors are clustered at the country–age–education level. Column (1) presents estimates for the baseline sample of 10 countries and excluding the oldest cohort from the analysis. Column (2) adds country–year effects. Column (3) includes the oldest cohort. Columns (4) and (5) show estimates for just women and men, respectively. Columns (6) and (7) present estimates for countries entering the EU in 2004 and 2007, respectively. ***,** ,* indicate statistical significance at a 1, 5, and 10 percent levels, respectively.

(1)–(3) in Table A6). This elasticity increases to 3.3 when including country–year effects (column (2)), to 3.15 when including the oldest cohort (column (3)), and falls to 1.84 when restricting the sample to NMS8 countries (column (6)). Substitutability between age groups is different for women and men: 16.44 for women and 1.7 for men, but the estimates are imprecise. This implies that a 1% increase in the relative wage of young women results in a 16% increase in the labor demand for older women. Statistical significance aside, these results imply that women of different ages are very substitutable in production, while men are less so. Overall, the estimates fall within the range established by other studies. For comparison, using U.S. data Borjas (2003) and Card and Lemieux (2001) estimate an elasticity ofsubstitution of 3.5 and between 3.8–4.9 across experience groups, respectively. Elsner (2013b) finds an elasticity of 1.6 using Lithuanian data.

Table 6 reports estimates of Equation (8) for similar specifications as in the previous tables. All specifications include country fixed effects, education–specific time trends and standard errors are clustered at the country–education level. The baseline estimate in column (1) is −0.52 and statistically significant, implying an elasticity of substitution of 1.95 between any two education groups. The result is robust to using estimated coefficients in constructing the labor composite, but is lower than the elasticity estimated using $\hat{\delta}_{it}$ as the dependent variable (see columns (5) and (6) in Table A6). The estimate is higher than those of Elsner (2013b) (1.61), Borjas (2003) (1.3) and Card and Lemieux (2001) (1.1 − 1.6). Compared to the estimate for σ_{AGE}, the result implies that similarly educated workers in different age groups are more substitutable than workers with different levels of education. The estimated elasticity falls between 1.3–3.2 depending on the specification. Adding country–year effects or education fixed effects increases the estimate to 2.1 and 3.2, respectively, although the latter estimate is imprecise (columns (2) and (3)). Including the oldest cohort in the analysis reduces substitutability

Table 6. Elasticities of Substitution across Education

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	CT	Edu	With old	Women	Men	NMS8	NMS2
Labor supply	−0.52**	−0.47***	−0.31	−0.75**	−0.43**	−0.42**	−0.56**	−0.40
	(0.21)	(0.17)	(0.22)	(0.36)	(0.20)	(0.18)	(0.23)	(0.29)
σ_{EDU}	1.92	2.11	3.21	1.33	2.35	2.36	1.80	2.52
First stage	−0.48***	−0.67***	−0.25	−0.38**	−0.50***	−0.52***	−0.47***	−1.05**
	(0.13)	(0.19)	(0.17)	(0.15)	(0.16)	(0.13)	(0.14)	(0.31)
F-stat	[13.5]	[12.7]	[2.2]	[6.9]	[10.5]	[17.1]	[11.6]	[11.7]
Adj. R^2	0.74	0.72	0.95	0.60	0.74	0.80	0.55	0.69
Obs.	120	120	120	120	120	120	96	24

Notes: This table presents IV estimates of Equation (7) and first–stage results. Foreign emigration rates are used as instruments for domestic labor supply. All specifications include country–specific fixed effects, education–specific time trends and standard errors are clustered at the country–age level. Column (1) presents estimates for the baseline sample of 10 countries and excluding the oldest cohort from the analysis. Column (2) adds country–year effects. Column (3) includes education fixed effects. Column (4) includes the oldest cohort. Columns (5) and (6) show estimates for just women and men, respectively. Columns (7) and (8) present estimates for countries entering the EU in 2004 and 2007, respectively. ***,**,* indicate statistical significance at a 1, 5, and 10 percent levels, respectively.

to 1.3 (column (4)). Women and men have similar substitutability across education groups (columns (5) and (6)). Finally, workers with different education levels are less substitutable in NMS8 countries than they are in NMS2 countries, which points to a different production technologies combining skilled and unskilled labor across the two groups of countries (columns (7) and (8)).

Finally, I exploit the panel of countries to estimate country–specific elasticities of substitution. Table 7 reports estimates of the labor supply coefficient by country using the baseline specification (columns (1)–(3)) and including the oldest cohort (columns (4)–(6)). In most cases, these estimates are negative, but are imprecisely estimated. In the baseline specification, the estimates for σ_{SEX} range from −0.02 in Lithuania, implying an elasticity of 50, to −0.60 in Bulgaria, implying an elasticity of 1.7 (column (1)). Column (2) reports country estimates of $-\frac{1}{\sigma_{AGE}}$. Half of the countries have positive coefficients, which is inconsistent with a CES technology and I omit any discussion. In column (3), the individual country elasticities of substitution between education groups are in the rage of $0.35 - 3$, but are imprecisely estimated. The lack of statistical significance is unsurprising given that each country has only 12 observations. While the estimates vary widely across countries, an equality test shows that the estimates are not statistically significantly different from one another.

Overall, the pooled elasticities of substitution are in line with those reported in other studies, but can vary slightly across specifications and widely (but statistically insignificantly) across countries. Whether and why estimates vary across specifications and across countries is an interesting question, but is beyond the scope of the paper. I thus proceed by using the baseline pooled estimates in calculating wage changes by country.

Table 7. Elasticities of Substitution by Country

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline			With old		
	σ_{SEX}	σ_{AGE}	σ_{EDU}	σ_{SEX}	σ_{AGE}	σ_{EDU}
Bulgaria	−0.60***	−1.53*	−0.40	−0.16***	0.05	−0.74
	(0.23)	(0.91)	(0.32)	(0.03)	(0.16)	(0.60)
Czech Republic	−0.24**	0.05	−0.87	−0.38	0.16*	−1.34
	(0.11)	(0.08)	(0.81)	(0.28)	(0.08)	(1.71)
Estonia	−0.09	6.67	−1.06	−0.00	1.38	2.18
	(0.21)	(21.55)	(2.16)	(0.16)	(1.33)	(4.50)
Hungary	−0.28**	−0.15	−0.41	−0.28**	−0.06	−0.73
	(0.14)	(0.12)	(0.32)	(0.12)	(0.11)	(0.46)
Latvia	0.17	0.03	−0.62	0.11	0.03	−1.58
	(0.44)	(0.12)	(0.48)	(0.33)	(0.11)	(1.78)
Lithuania	−0.02	0.30**	0.08	0.72	0.27**	0.05
	(0.09)	(0.13)	(0.15)	(49.54)	(0.11)	(0.16)
Poland	−0.19**	0.61	−2.82	−0.19	0.03	55.91
	(0.09)	(1.29)	(8.13)	(0.15)	(0.13)	(2735.46)
Romania	0.65	−0.40	−0.34	−0.36	−0.05	−0.72
	(1.03)	(0.38)	(0.34)	(0.34)	(0.10)	(0.58)
Slovakia	−0.11	−0.08	−0.61	−0.07	0.01	−0.79
	(0.09)	(0.08)	(0.63)	(0.10)	(0.03)	(0.90)
Slovenia	−0.10***	−0.19	−1.13*	−0.08	−0.11**	−1.70
	(0.04)	(0.55)	(0.68)	(0.05)	(0.05)	(1.40)
Prob>χ^2	0.32	0.18	0.48	0.71	0.06	0.50

Notes: The first three columns replicate the baseline regressions in Tables 4-6 separately by country. The last three columns replicate the baseline regressions including the oldest cohort in the analysis. Columns (1) and (4) present estimates of Equation (6), columns (2) and (5) of Equation (7) and columns (3) and (6) of Equation (8). Clustered standard errors are in parentheses. ***,** ,* indicate statistical significance at a 1, 5, and 10 percent levels, respectively.

4.2 Estimating Factor Price Elasticities

The net effect of emigration on wages requires knowledge of how wages of group x change when the labor supply of any group z changes. To this end, I take the partial derivative of $\log w_{ijk}$ with respect to $\log L_{xyz}$, for four different cases: (1) $xyz = ijk$, which gives own factor price elasticity (2) $xyz = ijk'$, $k' \neq k$, which gives cross–gender elasticity for workers with similar education and age, (3) $xyz = ij'k'$, $j' \neq j$, $k' \in \{Female, Male\}$, which gives cross–age factor price elasticity for workers with similar education and any gender, and (4) $xyz = i'j'k'$, $i' \neq i$ but age and gender can take any value, which gives the cross–education factor price elasticity. The own factor price elasticity is

$$\epsilon_{ijk,ijk} = -\frac{1}{\sigma_{SEX}} + \left(\frac{1}{\sigma_{SEX}} - \frac{1}{\sigma_{EXP}}\right)\frac{s_{ijk}}{s_{ij}} + \left(\frac{1}{\sigma_{EXP}} - \frac{1}{\sigma_{EDU}}\right)\frac{s_{ijk}}{s_i} + \left(\frac{1}{\sigma_{EDU}} - \frac{1}{\sigma_{KL}}\right)\frac{s_{ijk}}{s_L} + \frac{1}{\sigma_{KL}}s_{ijk} \tag{13}$$

where s_{ijk}, s_{ij}, s_i and s_L are the share of total income accruing to labor aggregates L_{ijk}, L_{ij}, L_i and L.[8]

The cross–gender factor price elasticity measures the sensitivity of earnings of female workers in group ij to changes in the labor supply of male workers in group ij, and vice versa. This elasticity is expressed as

$$\epsilon_{ijk,ijk'} = \Big(\frac{1}{\sigma_{SEX}} - \frac{1}{\sigma_{EXP}}\Big)\frac{s_{ijk'}}{s_{ij}} + \Big(\frac{1}{\sigma_{EXP}} - \frac{1}{\sigma_{EDU}}\Big)\frac{s_{ijk'}}{s_i} + \Big(\frac{1}{\sigma_{EDU}} - \frac{1}{\sigma_{KL}}\Big)\frac{s_{ijk'}}{s_L} + \frac{1}{\sigma_{KL}}s_{ijk'}. \quad (14)$$

The within education cross–age group factor price elasticity is

$$\epsilon_{ijk,ij'k'} = \Big(\frac{1}{\sigma_{EXP}} - \frac{1}{\sigma_{EDU}}\Big)\frac{s_{ij'k'}}{s_i} + \Big(\frac{1}{\sigma_{EDU}} - \frac{1}{\sigma_{KL}}\Big)\frac{s_{ij'k'}}{s_L} + \frac{1}{\sigma_{KL}}s_{ij'k'}. \quad (15)$$

It shows what happens to earnings of workers in group ijk when the labor supply changes for workers with the same level of education but different age (and of either gender). Finally, the cross–education elasticity measures the change in earnings of workers in group ijk following a change in the labor supply of workers in other education groups (and any age group and gender):

$$\epsilon_{ijk,i'j'k'} = \Big(\frac{1}{\sigma_{EDU}} - \frac{1}{\sigma_{KL}}\Big)\frac{s_{i'j'k'}}{s_L} + \frac{1}{\sigma_{KL}}s_{i'j'k'}. \quad (16)$$

All labor income shares except s_L are calculated from the data. To avoid picking up changes in relative labor income shares due to sudden emigration, these shares are calculated in the year prior to EU accession available in the data—2002 for NMS8 and 2006 for NMS2. A report on employment prepared by the European Commission in 2007 reports labor income shares for each new EU member state. These shares range from 44.3 in Slovakia to 68.2 in Romania. The average share is 54.7, thus I set s_L to 0.55.[9]

For brevity, Table 8 shows average factor price elasticities estimated using Equations (13) – (16).[10] Panel A reports elasticities for women and Panel B for men, by education and age group. Each cell shows the effect of a 1% increase in labor supply of the reference education–age–gender group on earnings of either the same education–age–gender group or other groups. Looking at highly educated women aged 50–59 reveals that a 10% increase in the labor supply of this group of women decreases earnings of these same women by 3%, decreases earnings of highly educated men aged 50–59 by 1.34%, decreases earnings of highly educated men or

[8] $s_{ijk} = \frac{w_{ijk}L_{ijk}}{\sum_{i,j,k} w_{ijk}L_{ijk}}$, with other shares defined analogously.

[9] See http://ec.europa.eu/social/BlobServlet?docId=2280&langId=en.

[10] When calculating wage changes, I use country–specific factor price elasticities.

Table 8. Average Factor Price Elasticities

		(1)	(2)	(3)	(4)
Education	Age	Own elasticity	Cross-sex	Cross-age	Cross-education
		Panel A: Women			
Low	<30	−0.266	−0.091	−0.005	0.000
	30-39	−0.281	−0.104	−0.007	0.000
	40-49	−0.293	−0.123	−0.008	0.000
	50-59	−0.289	−0.119	−0.005	0.000
Intermediate	<30	−0.280	−0.110	−0.003	0.003
	30-39	−0.277	−0.107	−0.004	0.003
	40-49	−0.292	−0.122	−0.005	0.004
	50-59	−0.280	−0.110	−0.003	0.003
High	<30	−0.304	−0.134	−0.003	0.001
	30-39	−0.309	−0.139	−0.007	0.003
	40-49	−0.323	−0.153	−0.009	0.004
	50-59	−0.304	−0.134	−0.006	0.003
		Panel B: Men			
Low	<30	−0.369	−0.199	−0.011	0.001
	30-39	−0.359	−0.189	−0.012	0.001
	40-49	−0.336	−0.166	−0.011	0.001
	50-59	−0.334	−0.164	−0.007	0.000
Intermediate	<30	−0.338	−0.168	−0.005	0.004
	30-39	−0.343	−0.173	−0.006	0.006
	40-49	−0.329	−0.159	−0.006	0.006
	50-59	−0.337	−0.167	−0.005	0.004
High	<30	−0.313	−0.143	−0.004	0.002
	30-39	−0.315	−0.145	−0.007	0.003
	40-49	−0.303	−0.133	−0.008	0.003
	50-59	−0.318	−0.148	−0.006	0.003

Notes: This table reports average factor price elasticities by education, age and gender. Panel A reports factor price elasticities for women, and panel B for men. All columns report the percentage change of wages in response to a 1% labor supply increase in the reference group. Column (1) corresponds to Equation (13) and reports the impact on wages of the same group. Column (2) corresponds to Equation (14) and reports the impact on wages of workers with the same education and age but different gender. Column (3) corresponds to Equation (15) and reports the impact on wages on any workers with similar education but different age. Column (4) corresponds to Equation (16) and refers to the impact on wages of all workers in different education groups. All estimations use the baseline elasticities of substitution estimated in Tables 4-6.

women younger than 50 by 0.06% and increases earnings of all non–highly educated workers by a negligible 0.03%, holding all other factors constant.

Several patterns are worth noting. Own, cross–gender, and cross–age elasticities are always negative, while cross–education elasticity is positive. In other words, a worker's earnings increase when workers with similar education levels leave, but decrease when workers with different education levels leave. Own elasticities of women are smaller in absolute value than those of men, meaning that women are less sensitive to changes in own group labor supply than men. Cross–gender elasticities of women are again smaller in absolute than men's. This means that when the labor supply of women of education–age group ij changes, men in group ij see their earnings change by less than in the opposite scenario. A similar pattern is present for cross–age and cross–education elasticities, but these elasticities are very small and I skip the

discussion. Column (1) also reveals that women become more sensitive to own group changes in labor supply the more educated they are, while the opposite is true of men. Column (2) further shows that changes in labor supply of women in group ij affect men's earnings in the same ij group more at higher levels of education than lower levels of education. On the other hand, changes in the labor supply of men in group ij affect women's earnings in the same ij group more at lower levels of education than at higher levels.

4.3 Estimating the Net Impact of Emigration on Earnings

Using the factor price elasticities calculated in section Section 4.2, I calculate the net effect of emigration on earnings as

$$\Delta \log w_{ijk} = \epsilon_{ijk,ijk} m_{ijk} + \sum_{k' \neq k} \epsilon_{ijk,ijk'} m_{ijk'} + \sum_{j' \neq j} \sum_{k'} \epsilon_{ijk,ij'k'} m_{ij'k'} + \sum_{i' \neq i} \sum_{j'} \sum_{k'} \epsilon_{ijk,i'j'k'} m_{i'j'k'} \quad (17)$$

where m_{ijk} is calculated using Equation (12).

Table 9 reports percentage wage changes due to emigration for the pooled sample. In calculating these wage changes, I use the baseline estimates for the elasticities of substitution for the pooled sample and country–specific factor price elasticities. The largest wage gains are concentrated among relatively young and among highly educated workers. Highly educated women and men in their 20s and 30s gained on average between 2.8–3.5% in wage increases. Among the low educated, the largest gains went to workers in their 30s and 40s, whose wages increased between 1.4–2.8%. High school graduates gained at most 0.7%. Averaging over all age groups, the largest gains went to highly educated women (2.2%). Averaging over education groups, workers in their 30s gained the most, and women gained more than men. The average wage gain over all education–age groups is 0.96% for women and 0.85% for men. Table A7 reports the wage changes due to emigration that occurred between 2002 and 2014. While many factors can affect wages within this 12–year period—increase number of immigrants to new EU member states, return migration, foreign investment flows—these estimates give an upper bound to wage changes due to migration. The distribution of wage gains is similar to that of short–run gains, with highly educated workers experiencing as much as a 12.8% increase in real wages. These results closely match the pattern of emigration rates (Table 2).

Table 9. Average Short–Run Wage Changes Due to Emigration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Female				Male			
Age	Low	Mid	High	All	Low	Mid	High	All
<30	0.42	0.27	2.76	0.74	0.57	0.28	2.76	0.66
30-39	2.39	0.69	3.45	1.52	2.84	0.69	3.28	1.32
40-49	1.36	0.50	1.70	0.88	1.74	0.53	1.70	0.84
50-59	0.40	0.25	1.11	0.50	0.55	0.23	1.04	0.41
All	1.27	0.46	2.23	0.96	1.53	0.46	2.20	0.85

Notes: This table reports real wage changes estimated using Equation (17) with country–specific emigration rates and pooled baseline elasticities of substitution reported in Tables 4-6. Colums (1)–(4) report wage changes accruing to women. Columns (5)–(8) report wage changes accruing to men. Columns (1) and (5) report wage changes for workers with low education, columns (2) and (6) for workers with intermediate level of education, columns (3) and (7) for those with high education, and columns (4) and (8) show weighted average changes over all education groups. Rows refer to workers less than 30 years old, between 30 and 39 years old, between 40 and 49 years old, between 50 and 59 years old, and the last row in each panel is a weighted average wage change over all age groups. The years considered are 2002 and 2006 for countries entering the EU in 2004, and 2006 and 2010 for countries entering the EU in 2007.

Using the baseline estimates of the elasticities of substitution and country–specific factor price elasticities and emigration rates, Table 10 shows detailed net changes of earnings by country. Romanian and Slovak workers saw the greatest increase in earnings due to emigration. In Romania, low–educated men and women between 30–49 years old saw their earnings increase between 5.5 and 6.2%. In Slovakia, the earnings of young high–educated workers increased by $7-8\%$. In contrast, Slovenian workers with little or intermediate education saw a decrease in earnings as a result of emigration, although these losses are not more than 0.6%. The Czech Republic, Hungary and Slovenia exhibit the smallest earnings gains from emigration, with the highest educated workers gaining the most. Yet, these gains barely exceed 1% in Hungary (30–39 year old females) and Slovenia (less than 30 year old females), and 1.46% in the Czech Republic (30–39 year old females).

The largest winners were highly educated workers, except in Estonia and Romania where low–educated workers had the largest gains. The same is true for low educated, 30–49 year old Latvians and Lithuanians. On the other hand, the smallest gains were concentrated among high school graduates (intermediate level of education). In almost every country and for every education group, gains to high school graduates are much lower than 1%, except in Romania and Bulgaria. This result is not surprising given that emigrants from new EU member states were mostly highly educated (and low educated in some countries), and given that in most countries more than half of the population has a high school degree. In all countries, highly educated workers below the age of 40 saw the largest gains. On the other hand, at low and intermediate levels of education, the highest gains are concentrated among 30–49 year old workers. Comparing the weighted average changes over age, the results show that highly educated women had higher increases in earnings due to emigration than highly educated men. The exceptions to this trend are Bulgaria, Lithuania and Poland. In most countries,

the differences in gains across men and women are small, except in Romania, where women gained half a percentage point more than men. For low educated workers, there are large differences in the earnings gains to men and women in some countries. In Estonia, the earnings of low educated men increased by almost 3%, while those of low educated women only 1.64%. There is no clear pattern across countries as to whose earnings increased more among low educated workers. For high school graduates, the average increase in earnings are well below 1% in most countries, except in Romania where female high school graduates gained 1.8% and male high school graduates had an increase of 1.7%. Looking at weighted average increases over education for men and women, in most countries the largest increases went to workers aged 30–39. Comparing average increases for women and men (the cross–section of columns (4), (8) and the last row within each country), Romanian, Bulgarian, Lithuanian and Slovak workers saw the largest increases in earnings (as high as 2.4% in Romania), while the average female and male workers in other countries gained less than 1%. In all countries except Estonia, the average female worker gained more than the average male worker.[11]

These findings are similar to those of Borjas (2003), which finds that workers with 11–25 years of work experiene were most affected by migration, and workers with some college and high school graduates (equivalent to intermediate education level in this paper) were least affected. My findings are also similar to those of Elsner (2013b), which finds that younger workers saw the greatest increases in earnings due to emigration. Overall, these results reveal that emigration can increase income inequality among workers with different education levels and decrease the gender wage gap.

5 Self–Selection of Workers

Section 4 shows net increases in earnings for the average worker across countries. However, it could be that earnings increased not because emigration reduced the supply of workers, but because the workers who left were in the lower end of the earnings distribution. In other words, emigrants were negatively selected on earnings and earnings of non–emigrants increased because of compositional effects. In this scenario the gains reported in Table 10 would be inflated. In estimating the effects of emigration on Mexican wages, Mishra (2007) deals with selection bias by using a subsample of male Mexican workers located in low migration Mexican states and finds robust effects of emigration on wages. Dustmann, Frattini, and Rosso (2015) deal with

[11] Tables A8 and A9 report estimated wage changes using country–specific elasticities of substitution and pooled elasticities of substitution that include workers aged 60 and up, respectively. Table A8 reports higher average wage gains for Bulgaria and Hungary, lower average wage gains in Slovakia, and overall wage losses in Slovenia. Table A9 shows that high school graduates saw wage decreases in almost all countries, and average wage gains are lower than in Table 10.

this issue by comparing the log–wage residuals of Polish emigrants and non–emigrants using pre–emigration data and find no significant difference in the two distributions. Using micro–level household data, Elsner (2013a) looks at the within–skill wage distribution in Lithuania before and after EU accession and concludes that there is no evidence of selection bias because the two distributions look identical.

The aggregated SES data does not allow me to perform any of the tests conducted by the studies above. Instead, I use micro–level data on immigrants from the German Socio–Economic Panel (SOEP). The SOEP is a representative longitudinal survey of households conducted since 1984. In 2013, the SOEP conducted an immigration–specific survey which included 2,700 households with at least one member who either emigrated to Germany after 1994, or whose parents emigrated to Germany. The immigration–specific survey asks respondents about their migration histories and, most importantly, about employment and earnings prior to their last entry to Germany. I restrict the sample to include only immigrants whose last entry to Germany is after 2001, and whose last country of residence before permanently moving to Germany is one of the 10 countries in my sample. Unfortunately, only Poland and Romania have a reasonable number of observations.

Table 11 shows summary statistics for the sample of immigrants from Poland (Panel A) and Romania (Panel B). Each row refers to the year in which the immigrant last arrived in Germany. Column (1) reports the number of immigrants entering Germany in a particular year. Columns (2)–(5) report the percentage of immigrants that are female, the average age, the average number of years in school and the percentage of immigrants that were unemployed prior to migration. In both panels, the number of observations increase right after EU accession (2004 for Poland and 2007 for Romania), which is consistent with the observed sudden emigration from these countries. After EU accession, the percentage of female immigrants decreases, the average immigrant becomes older, while the level of education is relatively stable over time. For both countries, less than half of the immigrants were unemployed right before migration. Column (6) reports average net monthly earnings received just prior to migration, weighted by the population weights provided by SOEP and reported in real 2002 euros.

Table 11. SOEP Descriptive Statistics

	(1)	(2)	(3)	(4)	(5)	(6)
Year	Obs.	% Female	Age	Years in school	Unemployed (%)	Wage (weighted)
Panel A: Poland						
2002	15	86.67	24.40	11.00	33.33	496.81
2003	14	71.43	24.14	11.15	50.00	303.36
2004	24	50.00	26.33	10.53	25.00	431.98
2005	30	63.33	26.83	11.45	13.33	564.82
2006	22	63.64	26.82	11.37	27.27	844.33
2007	24	62.50	32.79	11.61	37.50	347.77
2008	19	68.42	30.63	10.21	26.32	516.06
2009	11	45.45	29.55	11.00	18.18	496.98
2010	5	40.00	38.20	9.80	40.00	472.06
2011	10	50.00	37.90	10.90	10.00	420.13
2012	8	62.50	29.38	11.57	.	293.20
Panel B: Romania						
2002	7	71.43	25.29	10.50	42.86	105.85
2003	10	70.00	25.20	11.30	30.00	615.09
2004	14	64.29	25.50	11.92	42.86	284.44
2005	14	78.57	27.71	11.25	42.86	206.47
2006	11	81.82	28.45	11.30	63.64	75.36
2007	21	57.14	29.33	10.95	19.05	207.05
2008	15	60.00	34.33	10.87	.	162.36
2009	22	54.55	34.00	11.00	27.27	223.03
2010	20	45.00	31.05	11.74	10.00	250.88
2011	8	25.00	37.25	10.50	37.50	155.71
2012	7	85.71	36.57	12.00	42.86	167.05

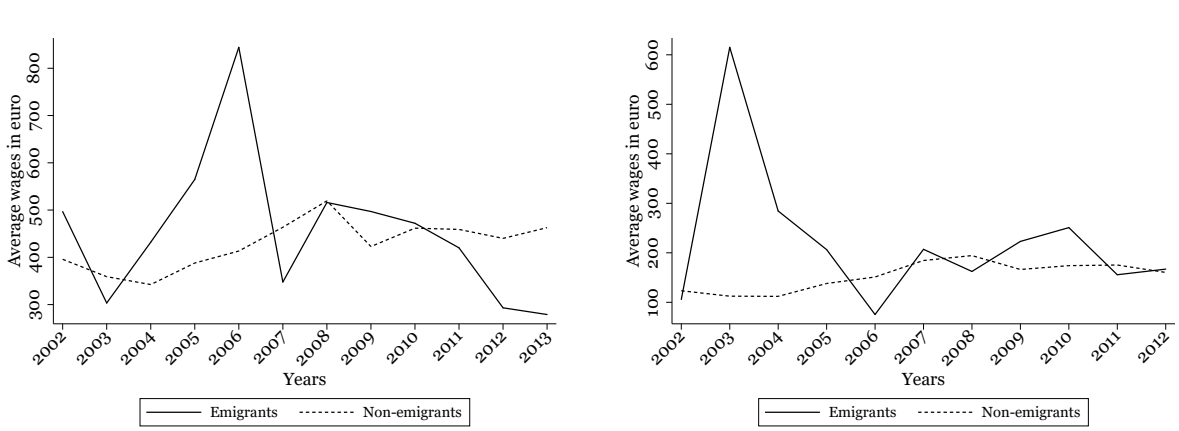
Notes: Year refers to the year of last entry to Germany for respondents coming from Poland (panel A) and Romania (panel B). Column (1) reports the number of respondents entering Germany each year. Column (2) reports the percentage of respondents that are female. Column (3) reports the average age of the respondents in the sample, while column (4) reports the average number of years spent in school. Column (5) shows the percentage of respondents that were unemployed prior to migration. Column (6) reports the average net monthly real wage earned in the sending country prior to migration. The average wage is weighted by population weights provided by SOEP and expressed in 2002 euros.

Figure 2 plots the weighted average pre–migration net monthly earnings reported in Table 11 and the net average real net monthly earnings for an average worker calculated based on data from Eurostat.[12] If emigrants' earnings were consistently above or below the earnings of non–emigrants, one could conclude that on average emigrants are positively or negatively selected. However, both figures lack any clear pattern that would indicate self–selection. While the sample size is too small to handle analysis for each education–age–gender group and ex-

[12]In its Earnings database, Eurostat reports annual net earnings for EU member countries (earn_nt_net). I use the earnings of an average single worker without children. I calculate monthly earnings by dividing annual earnings by 12 and deflate monthly earnings by the CPI with base year 2002 to get real monthly earnings.

ternal validity is not guaranteed, the comparison in Figure 2 removes some of the concern that self–selection is occurring on average.

Figure 2. Wages of Non-Emigrants and Emigrants



Notes: The figure shows the average net monthly wages earned by emigrants immediately prior to migration (solid line) and the average net monthly wages earned by non–emigrants, in Poland (panel A) and Romania (panel B). Wages are expressed in 2002 euros.

6 Conclusion

This paper uses a structural factor demand model to estimate the short–run effects of emigration on wages in 10 Central and Eastern European countries. It uses the EU enlargements in 2004 and 2007 and the ensuing large increase in emigration as shocks to labor supply. I estimate three elasticities of substitution—across education, within education and across age, and within education–age and across gender—which fall within the estimates in the existing literature. I then estimate factor price elasticities, which are large and negative except across education. The wage effect of emigration is on average positive across countries. However, there are large differences both across education and across age groups, and less so across gender. The largest wage gains went to young and highly educated workers, while workers with intermediate level of education experienced negligible gains, and even losses in some countries. The wages of low educated workers also increased substantially due to emigration, except in Slovenia. These results indicate that emigration can increase wage inequality. They also indicate the emigration helps reduce the gender wage gap, as the average female wage increase is more than the average male wage increase.

It is important to remember that these are short–term results. The wage effects are based on changes in the stock of emigrants right around EU accession, and assume that the capital stock doesn't change. This is a plausible assumption if firms face high adjustment costs. Fur-

ther research is needed to asses the long–term welfare gains or losses from emigration. Such findings would be informative for any region that experiences large population losses, whether it is an EU candidate country or a rural town in the US.

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Table 10. Wage Changes Due to Emigration

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Women				Men			
Country	Age	Low	Mid	High	All	Low	Mid	High	All
Bulgaria	<30	0.30	0.38	2.92	1.12	0.38	0.54	3.83	1.13
	30-39	1.55	1.07	2.40	1.54	1.59	1.19	2.74	1.55
	40-49	1.31	0.92	1.76	1.25	1.17	0.93	1.94	1.16
	50-59	0.65	0.60	1.12	0.79	0.62	0.56	1.20	0.69
	All	1.05	0.78	1.98	1.2	0.97	0.83	2.36	1.15
Czech Republic	<30	−0.09	−0.13	0.49	−0.07	−0.01	−0.05	0.80	0.05
	30-39	0.88	0.16	1.46	0.41	0.67	0.08	0.82	0.21
	40-49	0.14	0.02	0.40	0.08	0.16	0.00	0.27	0.05
	50-59	0.20	0.02	0.52	0.11	0.28	0.01	0.42	0.08
	All	0.27	0.01	0.72	0.12	0.25	0.01	0.58	0.1
Estonia	<30	0.58	0.14	0.74	0.43	0.76	0.14	0.85	0.37
	30-39	3.56	0.28	0.73	0.51	5.62	0.18	0.49	0.86
	40-49	2.46	0.12	0.22	0.25	4.28	0.09	0.20	0.51
	50-59	1.21	0.11	0.20	0.25	1.26	0.07	0.17	0.21
	All	1.64	0.15	0.42	0.33	2.97	0.12	0.41	0.51
Hungary	<30	−0.04	−0.09	0.40	−0.00	−0.01	−0.07	0.47	0.01
	30-39	0.18	0.08	1.11	0.33	0.17	0.05	0.77	0.18
	40-49	−0.04	−0.06	0.27	0.02	−0.07	−0.09	0.17	−0.05
	50-59	0.06	0.03	0.43	0.12	0.12	0.03	0.43	0.12
	All	0.03	−0.02	0.54	0.11	0.05	−0.02	0.45	0.07
Latvia	<30	0.51	0.37	3.86	1.26	0.35	0.29	3.18	0.78
	30-39	3.60	0.19	2.50	1.20	1.89	0.08	1.93	0.71
	40-49	1.30	−0.02	0.69	0.33	0.55	−0.05	0.50	0.17
	50-59	0.15	−0.09	0.44	0.10	0.09	−0.12	0.35	0.04
	All	1.25	0.11	1.66	0.69	0.77	0.06	1.3	0.43
Lithuania	<30	1.33	0.90	3.76	1.92	1.27	0.79	3.41	1.46
	30-39	3.53	0.44	3.79	1.90	6.04	0.36	3.38	1.53
	40-49	3.64	0.10	1.57	0.84	2.78	0.09	1.55	0.71
	50-59	0.52	−0.08	0.94	0.34	0.47	−0.12	0.78	0.16
	All	2.31	0.3	2.35	1.18	2.92	0.33	2.44	1.07
Poland	<30	0.37	0.13	3.13	0.84	0.42	0.17	3.35	0.76
	30-39	2.08	0.30	3.97	1.46	2.45	0.39	4.37	1.22
	40-49	0.47	−0.03	1.65	0.46	0.63	0.03	1.93	0.40
	50-59	0.34	0.07	1.72	0.59	0.40	0.08	1.90	0.45
	All	0.83	0.1	2.54	0.82	1.03	0.17	2.92	0.72
Romania	<30	1.43	1.02	3.38	1.20	1.58	1.08	3.24	1.27
	30-39	5.45	1.73	4.89	2.81	6.20	1.83	4.42	2.72
	40-49	5.61	2.58	4.20	3.24	5.97	2.37	3.56	2.92
	50-59	1.44	1.11	1.12	1.14	1.50	0.82	0.98	0.91
	All	4.22	1.77	3.6	2.41	4.24	1.67	3.09	2.17
Slovakia	<30	0.61	0.62	7.98	1.69	0.55	0.52	7.90	1.33
	30-39	2.59	0.68	8.17	1.89	2.94	0.61	7.27	1.64
	40-49	0.61	0.04	1.97	0.43	0.90	0.08	2.11	0.44
	50-59	0.33	0.01	1.50	0.34	0.59	0.06	1.59	0.36
	All	1.09	0.34	4.4	1.07	1.24	0.31	4.16	0.92
Slovenia	<30	−0.24	−0.04	1.11	0.19	−0.25	−0.04	1.01	0.00
	30-39	−0.22	0.02	0.94	0.17	−0.20	0.01	0.94	0.06
	40-49	−0.31	−0.01	0.57	0.04	−0.29	−0.01	0.59	0.01
	50-59	−0.40	−0.03	0.97	0.12	−0.58	−0.10	0.66	−0.04
	All	−0.28	−0.01	0.86	0.12	−0.29	−0.03	0.77	0.02

Notes: This table reports country–specific wage changes estimated using Equation (17) with country–specific emigration rates and pooled baseline elasticities of substitution reported in Tables 4-6. Colums (1)–(4) report wage changes accruing to women. Columns (5)–(8) report wage changes accruing to men. Columns (1) and (5) report wage changes for workers with low education, columns (2) and (6) for workers with intermediate level of education, columns (3) and (7) for those with high education, and columns (4) and (8) show weighted average changes over all education groups. Rows refer to workers less than 30 years old, between 30 and 39 years old, between 40 and 49 years old, between 50 and 59 years old, and the last row in each panel is a weighted average wage change over all age groups.

Appendix

Table A1. Real Wage Changes by Country

		(1)	(2)	(3)	(4)	(5)	(6)
		Female			Male		
Country	Age	Low	Mid	High	Low	Mid	High
Bulgaria	<30	44.85	45.72	36.66	40.51	44.40	35.37
	30-39	21.48	36.36	41.46	18.87	31.45	32.05
	40-49	18.78	23.06	30.34	20.78	29.73	40.28
	50-59	22.32	25.17	24.06	24.84	26.63	21.84
Czech Republic	<30	46.89	43.41	45.60	37.33	35.34	39.70
	30-39	34.06	41.65	44.88	33.43	39.32	36.50
	40-49	37.78	38.03	36.12	41.13	42.34	48.10
	50-59	35.54	32.83	35.61	36.55	36.80	44.15
Estonia	<30		28.89	7.32	84.93	52.95	3.59
	30-39		42.43	23.85	77.20	68.05	38.03
	40-49	54.59	56.11	35.18	64.72	50.13	39.05
	50-59	29.85	39.16	38.13	44.74	39.10	34.50
Hungary	<30	5.37	1.96	28.24	3.60	0.68	5.28
	30-39	2.28	6.98	24.92	−1.21	4.93	9.82
	40-49	5.52	3.19	18.86	5.04	4.05	9.75
	50-59	6.01	1.77	15.63	5.32	2.54	9.35
Latvia	<30	26.85	25.68	17.80	29.34	17.28	16.91
	30-39	8.77	20.47	22.80	14.91	23.37	27.47
	40-49	6.21	18.57	27.26	17.31	16.84	17.80
	50-59	−2.52	11.96	25.41	12.29	11.41	18.79
Lithuania	<30	19.97	35.04	40.01	31.14	46.19	34.40
	30-39	−6.68	24.03	36.30	15.73	39.92	38.02
	40-49	16.57	20.06	23.60	22.85	34.14	20.39
	50-59	18.99	17.49	23.48	17.60	40.60	25.53
Poland	<30	6.02	12.40	3.66	11.51	2.83	−3.46
	30-39	−3.70	1.08	5.42	1.12	−0.01	−5.86
	40-49	3.01	−3.55	1.85	7.78	1.53	1.24
	50-59	0.71	−5.90	1.89	1.54	−4.15	−5.94
Romania	<30	12.36	9.43	−0.79	8.09	11.46	19.67
	30-39	1.47	3.13	−13.48	−8.06	0.60	−5.58
	40-49	1.61	−3.45	−15.55	−1.55	3.40	−4.11
	50-59	−0.09	−12.30	−22.94	0.91	1.11	−13.22
Slovakia	<30	28.30	22.66	33.20	12.96	19.70	25.55
	30-39	18.34	22.07	19.65	6.73	20.41	19.13
	40-49	20.92	18.95	27.97	9.05	18.74	32.74
	50-59	23.05	18.21	29.04	5.29	13.75	17.83
Slovenia	<30	27.26	9.24	−5.01	16.01	16.13	−6.21
	30-39	−5.39	−2.42	−5.95	−0.22	2.84	1.36
	40-49	−4.68	−4.15	−9.00	1.38	−0.11	−6.81
	50-59	−11.15	−8.10	−11.02	1.31	−3.23	−8.65

Notes: This table replicates Table 1, by country. Columns (1)–(3) report real wage changes of women with low, intermediate and high education, respectively. Columns (4)–(6) are defined analogously for men. Pre and post–EU years are 2006 and 2010 for Bulgaria and Romania, and 2002 and 2006 for all other countries. Wages are in 2002 euros.

Table A2. Emigration Rates by Country

		(1)	(2)	(3)	(4)	(5)	(6)
		Women			Men		
Country	Age	Low	Mid	High	Low	Mid	High
Bulgaria	<30	0.92	1.05	5.24	1.36	1.98	10.64
	30-39	3.87	2.66	4.99	4.09	3.38	6.98
	40-49	3.72	2.54	3.84	2.89	2.63	4.86
	50-59	1.96	1.93	2.51	1.80	1.69	2.99
Czech Republic	<30	−0.35	−0.39	0.25	0.12	0.08	2.12
	30-39	2.35	0.60	4.82	1.11	0.17	1.01
	40-49	0.30	0.16	1.12	0.39	0.07	0.31
	50-59	0.33	0.14	1.30	0.80	0.09	0.71
Estonia	<30	1.25	0.50	1.59	1.07	0.47	2.25
	30-39	.	1.06	2.17	12.13	0.46	0.79
	40-49	.	0.49	0.60	10.68	0.34	0.50
	50-59	2.01	0.50	0.59	2.29	0.28	0.40
Hungary	<30	−0.08	−0.18	0.66	0.10	−0.04	1.10
	30-39	0.48	0.32	3.23	0.46	0.18	1.18
	40-49	0.05	0.04	0.76	−0.16	−0.19	0.13
	50-59	0.12	0.14	0.92	0.44	0.17	0.90
Latvia	<30	1.73	1.37	9.88	0.77	0.91	5.85
	30-39	13.29	1.04	6.41	3.24	0.39	3.06
	40-49	5.06	0.40	1.77	0.66	0.18	0.69
	50-59	0.57	0.22	1.08	0.25	0.05	0.57
Lithuania	<30	3.05	2.94	9.24	2.70	2.27	7.18
	30-39	.	1.78	9.32	14.76	1.36	6.88
	40-49	10.29	0.87	3.59	5.22	0.79	3.50
	50-59	1.15	0.49	2.37	0.83	0.30	1.38
Poland	<30	0.96	0.74	6.36	1.25	0.97	7.67
	30-39	4.07	0.99	7.99	6.23	1.52	10.34
	40-49	0.94	0.34	3.00	1.92	0.66	4.65
	50-59	0.86	0.64	3.32	1.26	0.74	4.36
Romania	<30	2.84	2.95	8.20	3.78	3.31	7.37
	30-39	10.82	4.45	12.21	15.20	5.08	9.42
	40-49	11.95	7.08	10.90	14.09	5.83	7.13
	50-59	3.10	3.99	3.09	3.43	2.23	2.24
Slovakia	<30	1.88	2.26	17.73	1.51	1.64	17.29
	30-39	5.76	2.34	19.98	7.79	1.91	14.71
	40-49	1.39	0.63	3.66	3.06	0.90	4.47
	50-59	0.69	0.56	2.63	2.23	0.83	3.19
Slovenia	<30	−0.31	0.00	2.52	−0.39	0.02	1.95
	30-39	−0.37	0.20	2.00	−0.21	0.10	2.01
	40-49	−0.54	0.11	1.14	−0.42	0.07	1.22
	50-59	−0.32	0.20	2.73	−1.40	−0.21	0.89

Notes: This table replicates Table 2, by country. Columns (1)–(3) report emigration rates of women with low, intermediate and high education, respectively. Columns (4)–(6) are defined analogously for men. Emigration rates are defined as in Equation (12). Pre and post–EU years are 2006 and 2010 for Bulgaria and Romania, and 2002 and 2006 for all other countries.

Table A3. Descriptive Statistics: Natives

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Women					Men				
Country	Year	Employees ('000)	% High	% Low	% Young	Wage	Employees ('000)	% High	% Low	% Young	Wage
Bulgaria	2002	909.30	31.38	12.78	47.61	125.65	833.57	20.31	17.34	46.92	159.49
	2006	1045.88	32.51	11.09	47.68	139.48	973.36	18.89	17.03	48.25	162.74
	2010	1024.43	35.20	8.89	44.65	188.55	918.52	22.26	11.13	50.12	223.22
	2014	1004.01	38.62	8.55	42.63	227.09	939.37	24.60	12.02	48.58	267.67
Czech Republic	2002	1635.00	12.16	11.31	50.06	399.19	1941.15	13.11	5.57	53.02	524.72
	2006	1613.19	15.39	8.43	49.39	573.47	2077.89	15.38	4.52	53.58	752.18
	2010	1626.61	21.16	7.32	48.00	658.73	1931.42	18.50	3.98	54.32	822.51
	2014	1662.22	23.24	5.46	44.73	591.04	1926.34	20.93	4.04	52.43	758.45
Estonia	2002	153.78	46.23	3.60	37.26	360.86	137.79	25.01	10.90	52.56	470.59
	2006	227.87	42.26	4.71	43.57	474.94	187.70	28.31	11.86	52.34	705.75
	2010	211.03	46.54	4.90	41.41	496.69	166.13	31.06	8.79	51.41	679.21
	2014	215.02	48.80	5.88	40.48	573.84	178.07	29.83	14.45	50.13	767.95
Hungary	2002	977.23	21.31	18.63	45.99	409.98	1073.80	16.49	14.38	51.99	505.70
	2006	952.99	24.07	15.76	43.20	466.05	995.94	16.41	13.37	51.78	541.83
	2010	1154.41	29.04	11.04	44.03	429.34	1200.97	20.90	10.18	50.81	499.94
	2014	1099.66	32.38	11.20	41.67	422.83	1192.29	23.36	12.13	49.08	480.90
Latvia	2002	268.01	31.77	7.99	46.42	265.69	262.22	20.56	15.98	50.50	325.32
	2006	426.86	34.30	6.43	47.33	329.18	344.98	21.72	15.06	52.72	389.03
	2010	340.37	42.91	4.09	41.64	343.77	271.70	27.26	9.59	49.21	400.33
	2014	377.40	48.58	3.03	40.83	427.35	318.22	28.40	9.30	49.89	505.23
Lithuania	2002	452.40	39.69	3.09	42.38	294.59	420.26	24.43	8.60	57.14	337.76
	2006	490.88	49.58	2.75	47.10	398.59	475.20	31.63	5.74	54.10	480.14
	2010	458.93	58.35	2.03	39.63	401.87	409.62	38.25	3.86	47.49	447.23
	2014	489.41	57.67	1.42	42.23	455.15	478.73	38.38	5.04	49.58	508.08
Poland	2002	2735.15	27.20	7.01	45.69	518.57	2896.84	17.38	8.04	51.15	657.86
	2006	2931.15	37.67	4.87	47.32	561.03	3138.47	22.87	7.12	49.36	693.37
	2010	3296.86	42.02	3.98	47.75	602.39	3506.02	25.88	6.00	53.51	715.65
	2014	3392.33	47.36	3.38	46.07	648.41	3532.62	29.56	5.34	53.26	790.52
Romania	2002	1701.08	20.86	13.24	53.29	177.99	2038.60	15.77	10.86	52.95	206.57
	2006	1726.19	19.54	11.62	52.62	210.06	2000.87	14.13	11.93	50.93	228.44
	2010	1688.19	33.92	10.42	46.48	223.79	1900.01	20.76	11.17	45.96	244.01
	2014	1830.93	33.29	11.43	44.36	231.59	2046.84	22.54	14.40	44.91	241.87
Slovakia	2002	725.20	16.69	6.89	48.02	289.97	720.44	15.05	3.45	47.80	396.16
	2006	785.89	17.66	6.02	46.89	357.51	835.36	18.00	3.07	49.43	484.85
	2010	686.19	26.74	4.08	44.07	520.62	739.72	19.42	2.83	48.42	645.34
	2014	724.30	32.14	4.46	41.01	555.09	733.08	25.29	3.30	47.79	698.77
Slovenia	2002	278.65	19.83	17.12	51.45	959.75	336.73	10.82	16.31	53.09	989.79
	2006	258.28	25.60	14.08	42.89	1002.98	282.88	17.26	12.23	42.69	1106.90
	2010	294.65	32.89	12.43	45.49	1067.80	360.28	19.04	13.44	50.10	1081.60
	2014	287.55	38.67	9.54	40.18	1040.03	344.24	22.16	11.17	47.27	1095.79

Notes: This table reports statistics on native employees by country, year and gender. Columns (1)–(5) report statistics on working women, and columns (6)–(10) on working men. Column (1) shows the number of employees in thousands, column (2) the percentage of employees with high education, column (3) the percentage of employees with low education, column (4) the percentage of employees less than 40 years old, and column (5) the weighted average wages in 2002 euros. Columns (6)–(10) are defined analogously. Statistics are based on data from the EU Structure of Earnings Survey.

Table A4. Descriptive Statistics: Emigrants

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Women				Men			
Country	Year	Emigrants ('000)	% High	% Low	% Young	Emigrants ('000)	% High	% Low	% Young
Bulgaria	2002	51.79	31.59	35.33	77.48	55.26	23.94	43.82	69.87
	2006	96.40	30.68	34.88	74.80	91.55	21.08	42.13	69.17
	2010	156.59	33.12	30.45	65.89	159.11	24.30	33.81	65.03
	2014	204.63	34.35	29.60	61.21	218.19	26.11	33.07	62.03
Czech Republic	2002	38.42	29.31	22.43	83.90	19.56	30.62	28.34	67.12
	2006	47.25	36.12	20.41	78.07	27.01	34.73	26.39	66.33
	2010	59.71	39.49	21.29	74.51	35.84	36.74	28.10	67.50
	2014	69.25	39.68	20.26	67.95	45.47	37.03	27.12	64.99
Estonia	2002	10.94	30.60	36.55	74.55	5.84	18.81	50.05	70.93
	2006	15.87	30.59	37.67	71.42	9.54	16.83	53.83	67.76
	2010	23.12	28.59	40.52	66.80	17.08	15.22	57.89	66.77
	2014	37.01	30.50	39.02	64.78	30.55	17.62	54.93	64.63
Hungary	2002	35.29	35.77	21.55	74.16	43.00	34.73	23.16	53.10
	2006	42.73	42.95	19.73	72.17	47.51	37.21	24.06	55.02
	2010	69.85	49.82	17.62	71.08	79.16	40.75	24.41	60.78
	2014	139.45	50.85	17.50	69.53	163.33	42.30	23.33	63.08
Latvia	2002	8.30	50.59	18.38	82.57	3.90	37.15	31.23	75.41
	2006	20.90	48.14	22.24	82.10	8.87	35.46	32.48	80.58
	2010	43.51	45.96	25.19	79.49	27.78	36.44	31.16	79.04
	2014	82.70	46.59	25.20	73.29	60.61	38.04	30.03	73.67
Lithuania	2002	20.56	40.68	24.18	85.43	11.05	29.96	32.11	82.78
	2006	56.40	44.14	26.11	81.56	35.16	32.15	33.74	80.66
	2010	90.31	46.34	25.85	76.07	67.73	35.28	32.19	76.57
	2014	131.91	47.75	24.76	71.44	108.11	37.04	30.02	72.21
Poland	2002	227.07	29.78	24.53	67.37	191.23	25.44	28.84	54.93
	2006	392.53	36.77	23.40	69.20	394.30	29.80	27.77	61.82
	2010	609.77	41.95	22.16	68.88	585.55	33.80	25.84	62.76
	2014	825.41	42.65	22.18	66.38	861.02	34.04	25.77	62.13
Romania	2002	170.73	17.63	39.42	81.89	173.78	14.64	44.13	76.98
	2006	490.38	15.49	40.95	82.68	442.54	11.30	46.64	79.40
	2010	852.86	16.10	37.70	70.41	795.24	12.04	41.14	72.14
	2014	1097.15	17.84	35.88	64.21	1001.64	14.57	37.98	67.28
Slovakia	2002	29.46	24.40	17.88	85.67	32.51	23.53	18.06	67.68
	2006	74.51	34.02	16.82	84.86	70.88	29.36	18.52	71.31
	2010	94.96	37.33	14.97	80.74	81.35	29.87	17.71	70.84
	2014	137.38	37.62	15.77	75.80	122.02	29.65	18.64	67.64
Slovenia	2002	13.11	24.11	35.66	51.59	13.74	22.80	32.93	48.59
	2006	14.57	33.61	27.50	53.35	13.90	29.50	26.32	50.78
	2010	12.96	43.49	18.43	55.60	13.06	36.36	19.44	54.92
	2014	17.59	46.68	15.99	62.79	21.54	37.85	18.87	60.24

Notes: This table reports statistics on emigrants by country, year and gender. Columns (1)–(4) report statistics on women, and columns (5)–(8) on men. Column (1) shows the number of emigrants in thousands, column (2) the percentage of emigrants with high education, column (3) the percentage of emigrants with low education, and column (4) the percentage of emigrants less than 40 years old. Columns (5)–(8) are defined analogously. Statistics are based on data from the EU Labor Force Survey and the OECD DIOC.

Table A5. σ_{SEX} across Education and Age

	(1)	(2)	(3)	(4)	(5)	(6)
	Pooled		NMS8		NMS2	
	2SLS	σ_{SEX}	2SLS	σ_{SEX}	2SLS	σ_{SEX}
Panel A:* σ_{SEX} *across education						
Low	0.01	−109.46	−0.09	11.54	−0.07	15.26
Mid	0.61	−1.65	0.50	−2.01	0.67***	−1.49
High	0.41	−2.41	0.51	−1.98	−2.14	0.47
Panel B:* σ_{SEX} *across age						
<30	−0.71	1.41	2.00	−0.50	−0.45	2.21
30-39	−0.06	17.63	−0.10	10.06	−0.10	9.88
40-49	−0.12*	8.43	−0.14**	7.27	0.25**	−4.01
50-59	−0.17	5.75	−0.22	4.61	−2.49	0.40
60+	−0.08	11.79	−0.12	8.33	−0.95	1.06

Notes: This table reports estimates of Equation (6) by education (panel A) and by age (panel B) for the pooled sample of 10 countries (columns (1) and (2)), for countries entering in 2004 (columns (3) and (4)) and countries entering in 2007 (columns (5) and (6)). All specifications include country fixed effects and standard errors are clustered by country–age–education.

Table A6. σ_{AGE} and σ_{EDU} using labor composites and $\hat{\delta}_{xt}$

	(1)	(2)	(3)	(4)	(5)	(6)
	σ_{AGE}			σ_{EDU}		
	Baseline	Composite	$\hat{\delta}_{ijt}$	Baseline	Composite	$\hat{\delta}_{it}$
Labor supply	−0.44**	−0.49**	−0.33	−0.51**	−0.49**	−0.26**
	(0.20)	(0.24)	(0.23)	(0.20)	(0.20)	(0.13)
σ	2.25	2.03	2.99	1.95	2.05	3.89
First stage coefficient	−0.15**	−0.14**	−0.15**	−0.49***	−0.50***	−0.49***
	(0.06)	(0.06)	(0.06)	(0.13)	(0.13)	(0.13)
F-stat	[5.9]	[4.8]	[5.9]	[13.8]	[14.9]	[13.8]
Adj. R^2	0.90	0.89	0.90	0.75	0.76	0.83
Obs.	480	480	478	120	120	120

Notes: This table reports estimates of Equations (6) (columns (1)–(3)) and (8) (columns (4)–(6)) using labor composites constructed with regression estimates (columns (2) and (5)) and the estimated fixed effect as opposed to observed wages (columns (3) and (6)).

Table A7. Long–run average wage changes (2002–2014)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Female				Male			
Age	Low	Mid	High	All	Low	Mid	High	All
<30	1.38	0.50	8.51	2.03	1.77	0.52	8.95	1.83
30-39	8.89	1.86	12.80	5.18	11.24	1.82	12.19	4.42
40-49	3.27	1.09	6.26	2.56	4.57	1.11	6.20	2.28
50-59	1.05	0.72	4.14	1.68	1.40	0.62	3.72	1.28
All	4.02	1.10	7.98	3.01	5.16	1.07	7.84	2.57

Notes: This table reports replicates Table 9 using the change in emigrant stock from 2002 to 2014.

Table A8. Wage Changes using country–specific σ_{EDU}, σ_{AGE} and σ_{SEX}

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Women				Men			
Country	Age	Low	Mid	High	All	Low	Mid	High	All
Bulgaria	<30	−1.02	−0.22	5.10	1.27	−0.75	0.34	8.34	1.65
	30-39	3.34	2.17	3.33	2.66	3.47	2.60	4.53	3.10
	40-49	2.51	1.65	1.12	1.57	2.01	1.70	1.73	1.75
	50-59	0.18	0.53	−1.11	−0.09	0.09	0.39	−0.83	0.10
	All	1.59	1.16	1.87	1.44	1.3	1.35	3.21	1.69
Hungary	<30	0.05	0.01	0.36	0.08	0.10	0.05	0.48	0.12
	30-39	0.15	0.11	0.94	0.30	0.14	0.07	0.37	0.13
	40-49	0.10	0.07	0.45	0.16	0.04	0.01	0.28	0.05
	50-59	0.07	0.07	0.44	0.15	0.16	0.07	0.43	0.16
	All	0.09	0.06	0.56	0.17	0.11	0.05	0.39	0.11
Slovakia	<30	0.80	−0.04	5.07	0.75	0.76	−0.10	5.02	0.49
	30-39	1.08	−0.03	5.34	0.82	1.31	−0.08	4.76	0.66
	40-49	0.74	−0.18	3.92	0.62	0.92	−0.15	4.01	0.56
	50-59	0.68	−0.19	3.84	0.71	0.85	−0.16	3.90	0.63
	All	0.83	−0.11	4.44	0.71	0.96	−0.12	4.33	0.58
Slovenia	<30	−1.08	−0.54	1.39	−0.17	−1.08	−0.53	1.33	−0.49
	30-39	−1.07	−0.50	1.31	−0.23	−1.06	−0.51	1.31	−0.43
	40-49	−1.11	−0.52	1.15	−0.34	−1.10	−0.52	1.16	−0.43
	50-59	−1.13	−0.52	1.35	−0.22	−1.24	−0.56	1.17	−0.36
	All	−1.09	−0.52	1.28	−0.26	−1.1	−0.53	1.23	−0.43

Notes: This table replicates Table 10 using baseline country–specific elasticities of substitution reported in Table 7.

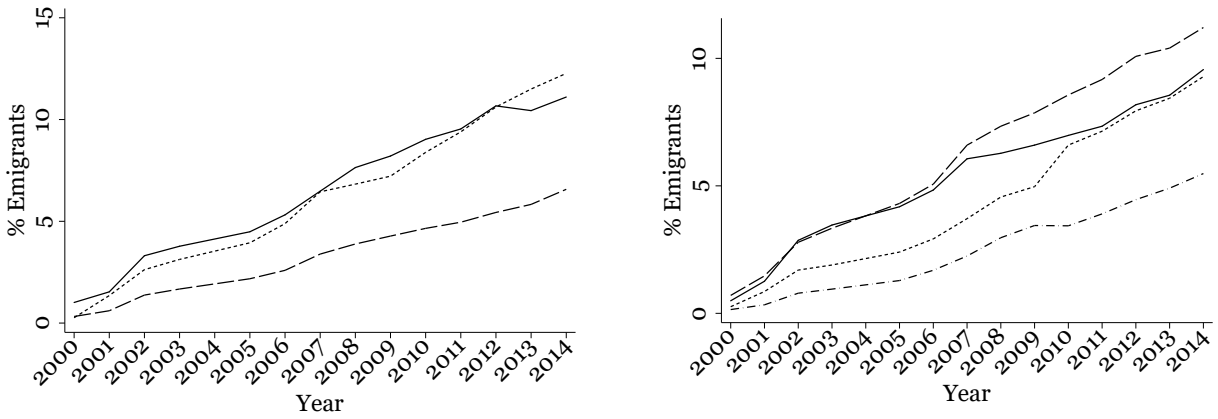
Table A9. Wage Changes due to Emigration (with oldest cohort)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Women				Men			
Country	Age	Low	Mid	High	All	Low	Mid	High	All
Bulgaria	<30	−0.23	−0.30	2.28	0.46	−0.16	−0.16	3.09	0.45
	30-39	0.66	0.18	1.96	0.79	0.69	0.29	2.26	0.72
	40-49	0.51	0.09	1.53	0.62	0.38	0.10	1.68	0.44
	50-59	0.02	−0.13	1.08	0.31	0.00	−0.17	1.15	0.12
	60+	−0.48	−0.53	0.56	−0.12	−0.48	−0.57	0.52	−0.26
	All	0.29	−0.02	1.64	0.56	0.21	0.01	1.89	0.41
Czech Republic	<30	−0.02	−0.23	0.59	−0.12	0.05	−0.16	0.87	−0.03
	30-39	0.69	−0.01	1.40	0.25	0.50	−0.07	0.83	0.08
	40-49	0.15	−0.11	0.59	0.01	0.16	−0.12	0.47	−0.03
	50-59	0.18	−0.11	0.66	0.03	0.25	−0.12	0.58	0.00
	60+	0.08	−0.12	0.57	0.01	0.08	−0.13	0.43	0.02
	All	0.23	−0.12	0.81	0.03	0.22	−0.12	0.67	0.01
Estonia	<30	1.82	−0.11	0.48	0.18	1.99	−0.11	0.58	0.32
	30-39	3.59	0.00	0.51	0.26	5.41	−0.09	0.30	0.61
	40-49	2.94	−0.12	0.13	0.10	4.55	−0.15	0.11	0.36
	50-59	2.30	−0.13	0.12	0.19	2.34	−0.16	0.09	0.14
	60+	1.67	−0.25	−0.01	0.06	1.68	−0.25	−0.01	−0.03
	All	2.23	−0.12	0.23	0.15	3.46	−0.13	0.23	0.34
Hungary	<30	−0.13	−0.21	0.47	−0.08	−0.10	−0.19	0.54	−0.07
	30-39	0.02	−0.08	1.02	0.18	0.02	−0.10	0.72	0.04
	40-49	−0.12	−0.18	0.40	−0.03	−0.15	−0.21	0.31	−0.12
	50-59	−0.06	−0.12	0.50	0.03	−0.01	−0.12	0.50	0.02
	60+	−0.11	−0.13	0.32	0.01	−0.11	−0.13	0.30	0.03
	All	−0.08	−0.15	0.59	0.02	−0.07	−0.16	0.5	−0.03
Latvia	<30	0.41	−0.24	3.20	0.68	0.26	−0.31	2.59	0.27
	30-39	2.81	−0.36	2.22	0.73	1.30	−0.45	1.72	0.21
	40-49	1.04	−0.51	0.91	0.10	0.38	−0.55	0.75	−0.11
	50-59	0.13	−0.57	0.73	−0.10	0.08	−0.59	0.65	−0.17
	60+	0.02	−0.59	0.53	−0.17	0.02	−0.59	0.52	−0.27
	All	0.88	−0.43	1.52	0.3	0.49	−0.48	1.24	0.03
Lithuania	<30	1.80	−0.20	3.13	1.01	1.75	−0.30	2.82	0.61
	30-39	2.95	−0.54	3.15	1.07	5.16	−0.60	2.78	0.66
	40-49	3.53	−0.78	1.55	0.34	2.76	−0.79	1.54	0.13
	50-59	1.23	−0.91	1.12	−0.03	1.18	−0.94	0.97	−0.28
	60+	0.93	−1.00	0.63	−0.09	0.93	−1.01	0.60	−0.32
	All	2.36	−0.65	2.03	0.52	2.82	−0.64	2.03	0.32
Poland	<30	0.08	−0.68	3.13	0.24	0.13	−0.65	3.33	0.13
	30-39	1.25	−0.57	3.72	0.77	1.57	−0.49	4.07	0.44
	40-49	0.14	−0.80	2.09	0.06	0.29	−0.75	2.34	−0.14
	50-59	0.06	−0.72	2.15	0.21	0.12	−0.71	2.31	−0.08
	60+	−0.23	−0.90	1.19	−0.05	−0.24	−0.91	1.13	−0.12
	All	0.39	−0.7	2.71	0.3	0.55	−0.65	2.95	0.09
Romania	<30	1.96	−0.11	2.68	0.35	2.10	−0.06	2.56	0.47
	30-39	4.74	0.38	3.78	1.59	5.39	0.48	3.36	1.47
	40-49	4.88	1.02	3.30	1.91	5.20	0.83	2.74	1.56
	50-59	1.98	−0.00	1.09	0.49	2.03	−0.27	0.97	0.19
	60+	1.05	−0.87	0.46	−0.53	1.04	−0.91	0.38	−0.56
	All	3.89	0.42	2.86	1.3	3.96	0.34	2.42	1.06
Slovakia	<30	0.12	−0.47	7.32	0.69	0.07	−0.56	7.26	0.33
	30-39	1.49	−0.43	7.55	0.85	1.79	−0.49	6.75	0.62
	40-49	0.10	−0.90	3.07	−0.11	0.35	−0.86	3.19	−0.16
	50-59	−0.10	−0.92	2.74	−0.10	0.13	−0.87	2.82	−0.15
	60+	−0.37	−1.04	2.32	0.08	−0.33	−1.04	2.20	0.10
	All	0.43	−0.68	4.78	0.31	0.57	−0.7	4.52	0.14
Slovenia	<30	−0.54	−0.22	1.18	0.05	−0.56	−0.22	1.10	−0.18
	30-39	−0.54	−0.17	1.06	0.01	−0.52	−0.19	1.06	−0.13
	40-49	−0.60	−0.20	0.80	−0.10	−0.58	−0.20	0.81	−0.15
	50-59	−0.64	−0.21	1.11	0.01	−0.80	−0.27	0.84	−0.15
	60+	−0.29	−0.06	1.31	0.63	−0.23	−0.03	1.29	0.43
	All	−0.57	−0.19	1.01	−0.02	−0.58	−0.21	0.95	−0.14

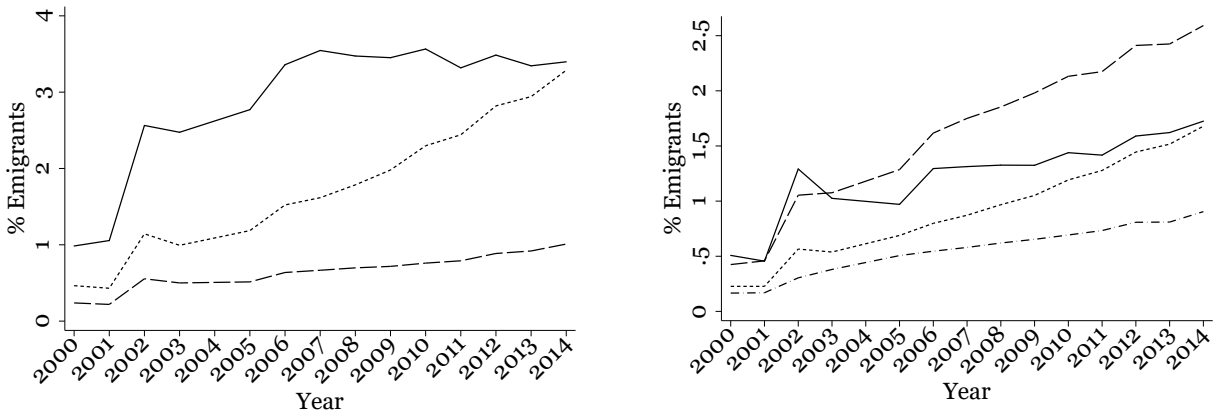
Notes: This table replicates Table 10 using pooled baseline elasticity of substitution estimates reported in Tables 4-6 and including workers older than 60 years.

Figure 1. Emigrants as % of working age population (native plus emigrants)

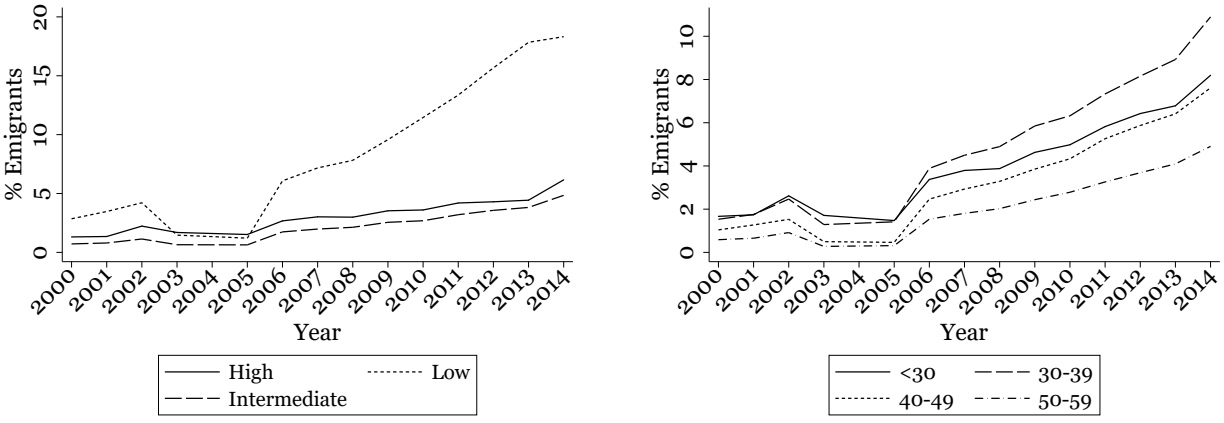
Bulgaria



Czech Republic



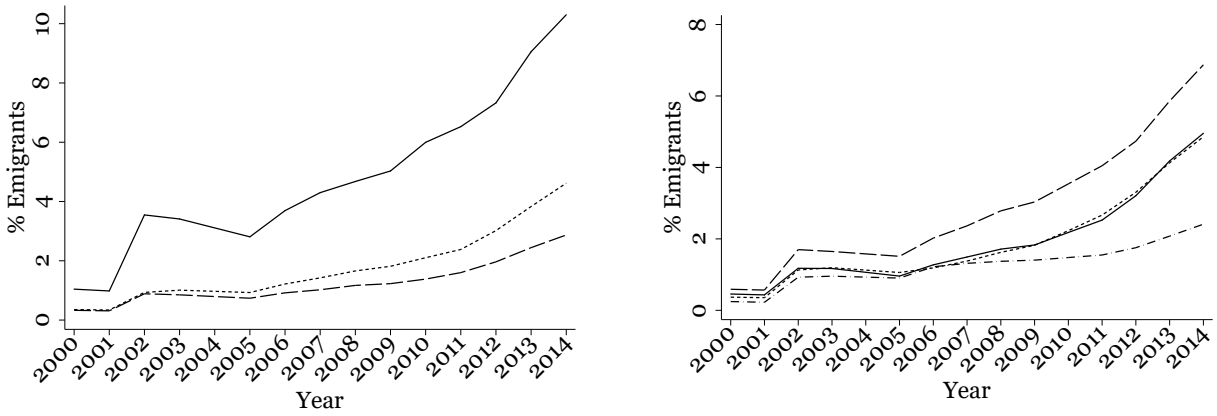
Estonia



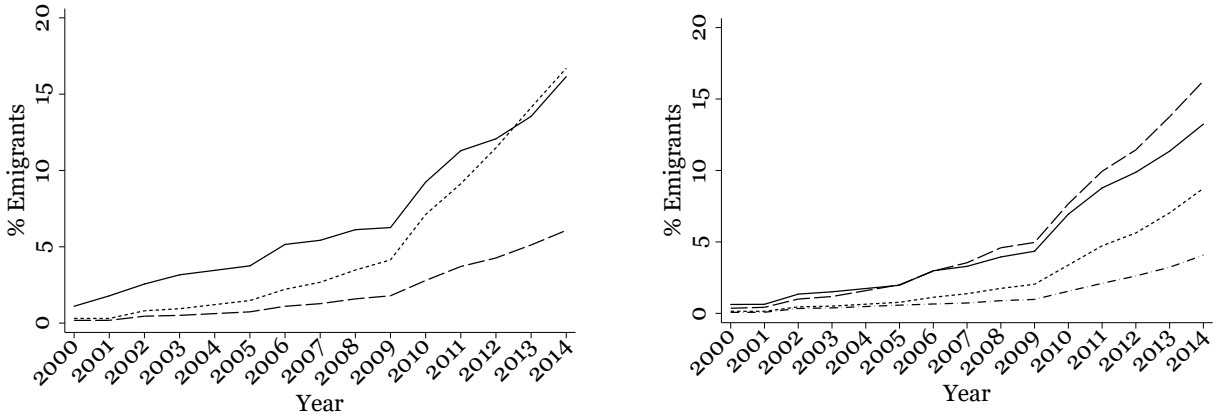
Notes: The figure shows the emigrant share broken down by education (left panel) and by age (right panel). Emigrant shares are calculated according to Equation (11). The stock of emigrants is proxied by the stock of immigrants as measured by receiving countries. Data for 2004 is ommitted as there is missing information on several receiving countries. Data come from the EU Labor Force Survey and the OECD DIOC.

Figure 1 (cont.). Emigrants as % of working age population (native plus emigrants)

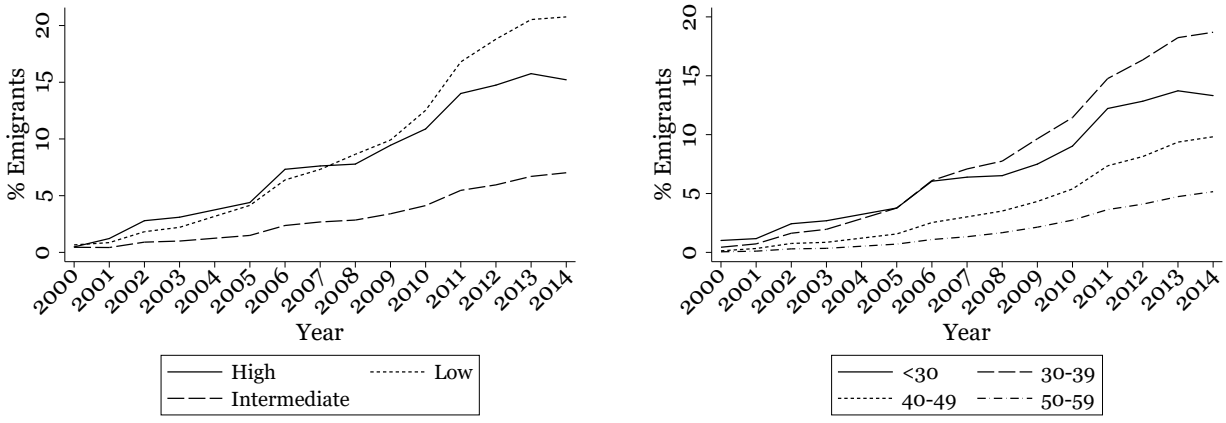
Hungary



Latvia



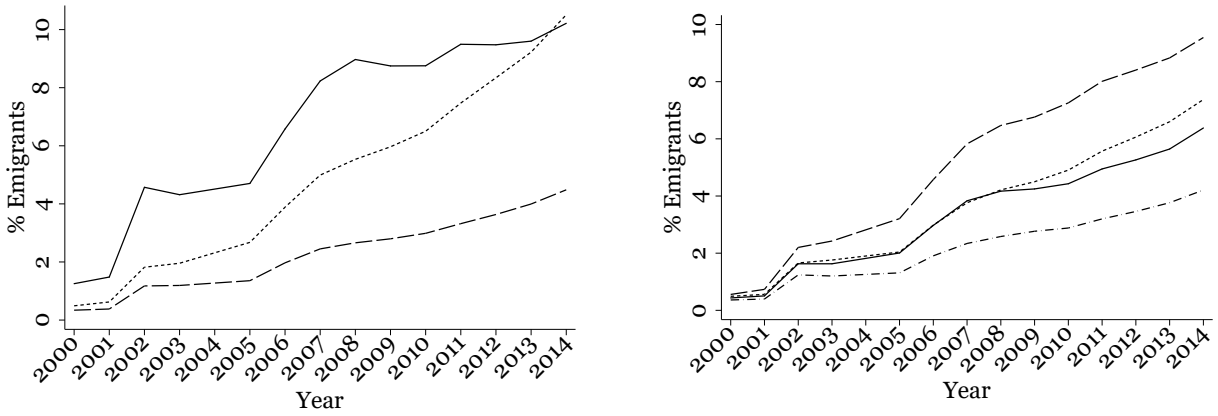
Lithuania



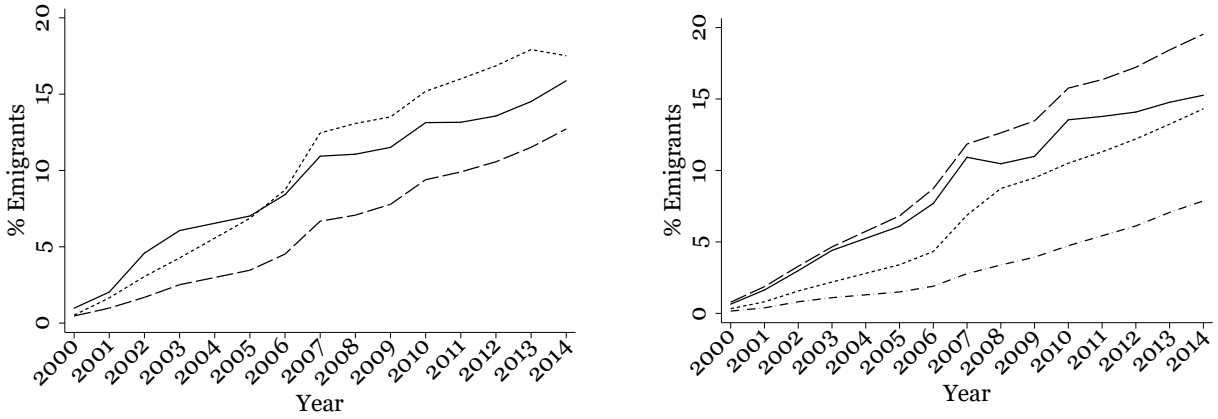
Notes: The figure shows the emigrant share broken down by education (left panel) and by age (right panel). Emigrant shares are calculated according to Equation (11). The stock of emigrants is proxied by the stock of immigrants as measured by receiving countries. Data for 2004 is ommitted as there is missing information on several receiving countries. Data come from the EU Labor Force Survey and the OECD DIOC.

Figure 1 (cont.). Emigrants as % of working age population (native plus emigrants)

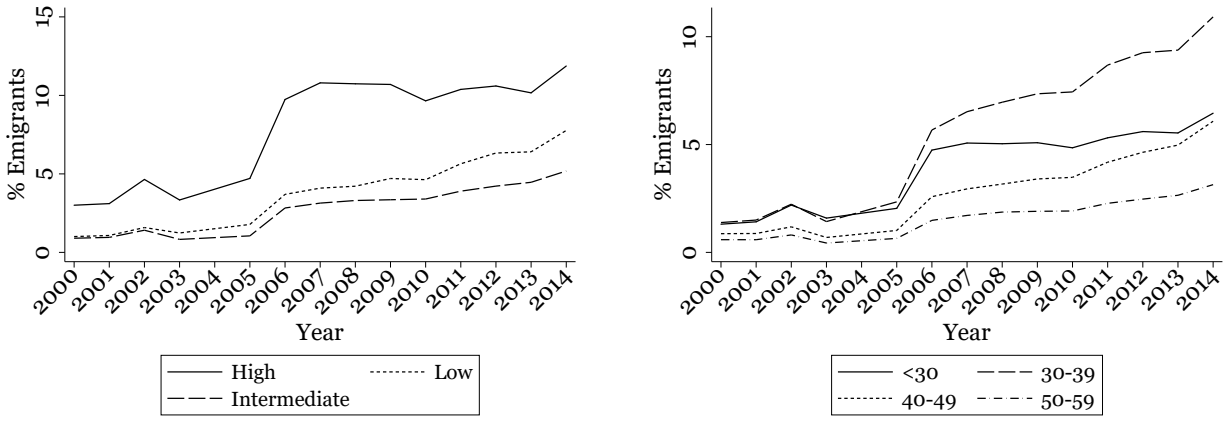
Poland



Romania

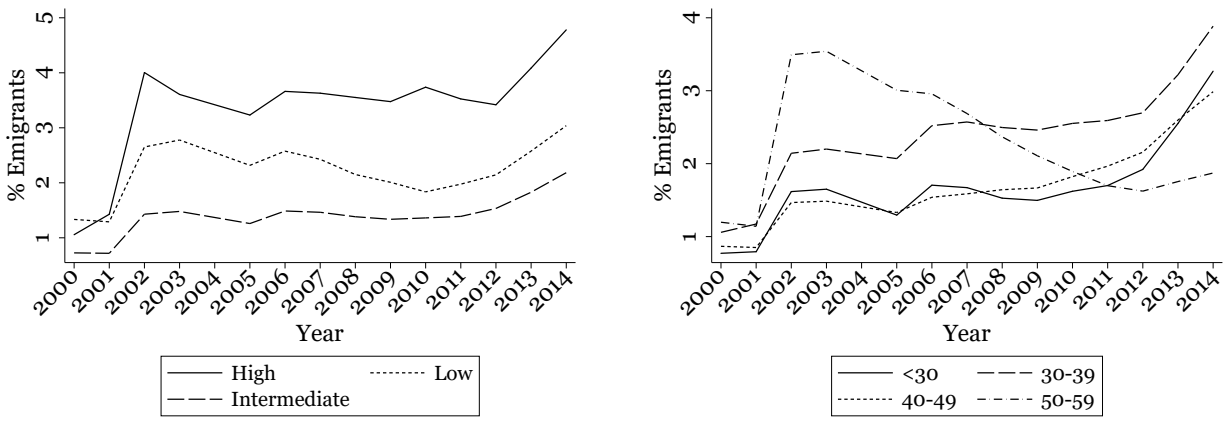


Slovakia



Notes: The figure shows the emigrant share broken down by education (left panel) and by age (right panel). Emigrant shares are calculated according to Equation (11). The stock of emigrants is proxied by the stock of immigrants as measured by receiving countries. Data for 2004 is ommitted as there is missing information on several receiving countries. Data come from the EU Labor Force Survey and the OECD DIOC.

Figure 1 (cont.). Emigrants as % of working age population (native plus emigrants)
Slovenia



Notes: The figure shows the emigrant share broken down by education (left panel) and by age (right panel). Emigrant shares are calculated according to Equation (11). The stock of emigrants is proxied by the stock of immigrants as measured by receiving countries. Data for 2004 is ommitted as there is missing information on several receiving countries. Data come from the EU Labor Force Survey and the OECD DIOC.