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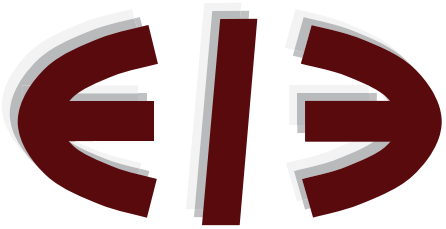

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Comparing the immigrant-native pay gap: A novel evidence from home and host countries*

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Abstract

We estimate wage differentials and compare inequality trends between foreign-born and native-born workers across developed economies and developing economies. We leverage large internationally harmonised microdata covering 21 countries, 20 years and 1.5 million individuals and employ Blinder-Oaxaca counterfactual decomposition techniques. We find that vis-à-vis comparable workers born in developed countries, the workers born in developing economies are disadvantaged both in their home country labour markets and – if migrating – also in developed host countries. The estimated Blinder-Oaxaca wage differentials suggest the opposite for workers born in developed countries – their wages are higher not only in developed countries but for migrants also in developing host countries. After accounting for personal and job-related characteristics, at least 28% of the total native-to-migrant wage gap still remains unexplained. The unexplained wage gap has increased during the last decade and can be attributed to the labour market discrimination, differences in unobserved job characteristics, variation in unobserved skills, and the institutional labour market framework.

Keywords: labour market, wage gaps, immigrants, decomposition.

JEL codes: D31, J15, J7.

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1. INTRODUCTION

> *"I, JOSEPH R. BIDEN JR., President of the United States of America, by virtue of the authority vested in me by the Constitution and the laws of the United States, do hereby proclaim March 24, 2021, as National Equal Pay Day."*[1]

The world counts an estimated 164 million migrant workers, more than half of them from developing countries (ILO 2020). They comprise 4.7% of the global workforce and contribute enormously to the societies' growth and development. Yet, migrant workers are often treated unfairly and unequally in the labour market. Indeed, the literature has documented substantial employment and earnings differentials between immigrants and native-born.

Studies on developed countries report positive differences in labour market outcomes between native-born and immigrants (e.g, Lehmer and Ludsteck (2011) for Germany; Van Kerm et al. (2016) for Luxembourg; Longhi et al. (2013) for the UK; Ruist (2013), Bertrand and Mullainathan (2004), and Smith and Fernandez (2017) for the US and Canada). The employment disadvantage for foreign-born workers compared to native-born is similarly persistent. For instance, Zschirnt and Ruedin (2016) review 36 studies in OECD countries and find that a median call-back rate for minorities relative to native-born whites is only 67%, implying that employers tend to set a significantly higher bar for minority candidates, or avoid hiring minorities altogether.

In contrast, there is considerably less evidence on the magnitude of wage differentials and inequality trends of foreign-born vis-à-vis native-born workers in economies in developing economies.[2] The scarce available evidence hints at a *negative wage gap*, implying that wages for foreign-born workers are *higher* than for native-born workers in these countries. Immigrant worker earnings have been found to be substantially higher, for example, in Kyrgyzstan (22%-25%), Rwanda (12%-15%) and Ghana (12%) (OECD/ILO 2018). In South Africa, newly arrived immigrant workers are found to increase the negative wage gap between native-born and immigrant workers. Gerard et al. (2020) estimate an ethnic wage gap between whites and non-whites natives in Brazil in a range of 27% to 33%, disproportionately disadvantaging the native non-white population.

The present study estimates the labour earning and compares wages of natives in developed countries vis-à-vis migrants (from other developed and from developing countries), and wages of natives in developing countries vis-à-vis migrants (from other developing and from developed countries). To account for the fact that the decomposition of global inequality into between-country and within-country inequality is highly sensitive to data measurement issues (Ferreira et al. 2021), we leverage a large internationally harmonised microdata – the Luxembourg Income Study (LIS) – covering 21 countries, 20 years and around 1.5 million

[1] www.whitehouse.gov/briefing-room/presidential-actions/2021/03/24/a-proclamation-on-national-equal-pay-day-2021/.

[2] Throughout the paper, we follow the United Nations World Economic Situation and Prospect (WESP) classification of countries into three broad categories: developed economies, economies in transition and developing economies. https://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf. In the paper, we use 'developing countries' to abbreviate 'economies in transition and developing economies'.

individuals and employ counterfactual decomposition techniques to compute the levels of wage differentials and inequality trends of foreign-born and native-born workers. We find that vis-à-vis comparable workers born in developed economies, the workers born in transition and developing economies are disadvantaged both in their home country labour markets and – if migrating – also in developed host country labour markets. The opposite is true for workers born in developed countries – the estimated wage differentials are negative. Our estimates also show that in the developed country sub-sample, the mean immigrant wage disadvantage has remained nearly unchanged during the last two decades both in terms of the inequality trend and variance. The magnitude and growth rate of the mean wage gap for the transition/developing economies sub-sample is similar to developed economies though with the opposite sign – comparable native-born workers in developing countries systematically receive lower wages than foreign-born workers at the mean.

Our paper is related to the large body of the inequality literature, showing that a significant part of the observed raw differences in labour market outcomes between heterogenous groups of workers can be explained by *productivity differences* (Dustmann and van Soest 2002; Ferrer et al. 2006; Hellerstein and Neumark 2003; Bratsberg and Ragan 2002). Two sources for productivity differentials between immigrants and native-born have been identified in the literature: intrinsic productivity differences between immigrants and native-born, and segregation into labour market categories with a differentiated productivity. Whereas intrinsic productivity effects capture differences between natives and immigrants *within* the same category (e.g. unequal productivity between immigrants and natives within the same occupation), sorting refers to differences in the distribution of natives and immigrants *between* categories that each encompasses a distinct level of productivity (e.g. overrepresentation of immigrants in occupations with lower productivity/wage) (Autor and Katz 1999; Lemieux 2006).

Productivity differences alone, however, are not able to explain fully why heterogenous groups of workers receive different wages for an otherwise comparable work when being employed. Even when controlling for work characteristics, including industry, occupation, firm size, location, skills intensity, etc., 28% and more of the total native-to-migrant wage gap still remains unexplained across the 21 countries covered in this paper. Usually, the literature attributes the unexplained wage gap to a *labour market discrimination* between migrants and natives (e.g. Lehmer and Ludsteck 2011; Bartolucci 2014; Abdullah et al. 2020). According to Arrow (1973), in addition to market-valued factors such as differences in worker productivity and job characteristics, a number of migrant-specific characteristics (unrelated to productivity and job characteristics) may contribute to explaining gaps in labour market outcomes between immigrants and native-born. Using the example of Arrow (1973, p.2): "*The black steel worker may be thought of as producing blackness as well as steel, both evaluated in the market.*" Depending on whether 'blackness' has a positive or negative market valuation, it is referred to as a positive or negative discrimination, whereby it has no direct relation to the worker productivity.[3] In the presence of a negative discrimination, equally productive immigrant workers are treated worse than native-born workers (documented for most developed economies) and vice versa. At the firm level, the discrimination of hiring/remunerating

[3] Arrow (1973) has described a worker discrimination in the labour market as "the valuation in the market place of personal characteristics of the worker that are unrelated to worker productivity".

immigrants compared to native-born implies a negative marginal rate of substitution of profits for immigrant workers at any given immigrant/native ratio (Kampelmann and Rycx 2016).

An additional common cause of the unexplained wage gap is unobserved (or omitted in the data) information about productivity of immigrants and natives and factors affecting it, particularly, when conducting estimations at the individual level. According to Nicodemo and Ramos (2012), García-Pérez et al. (2014), or Christl (2020), wage inequality is expected to be also driven by between- and within-industry-occupation inequalities. For example, the decomposition results of Tang et al. (2020) imply that in the US the within-job inequality accounts for more than 80% of the unexplained wage inequality between 1983 and 2013. This suggests that the heterogenous labour market groups must differ according to some further characteristics valued on the market. Such unmeasured characteristics may include group differences in the labour force attachment due to job characteristics, or differences in unobserved skills. Further, institutional framework governing labour markets impacts the way wages are set in a given economy (Plasman et al. 2007; Ohlert et al. 2016; Lemieux et al. 2009). The incidence of these factors (including the labour market discrimination) varies strongly across country and thus are expected to generate cross-country variation of the unexplained wage gap.

With respect to *differences in unobserved job characteristics*, it is widely accepted that there is a penalty associated with non-standard forms of employment (e.g. temporary employment, part-time work, temporary agency work, seasonal work and dependent self-employment); workers are usually paid lower wages for non-standard forms of employment than standard jobs (e.g., Hotchkiss and Pitts 2007; OECD 2015b). This penalty for non-standard forms of employment is often argued to be an important source of the lower wages observed for immigrants relative to native-born, as immigrants generally have higher incidence of this form of employment (ILO 2015, 2016; OECD/ILO 2018). Further, various other missing or unobserved between-job (e.g. occupation types in terms of tasks and duties carried out) and within-job differences (e.g. performance-pay versus fixed hourly wage and skill (mis)match; the relatedness between the field of study and the occupation at the current job) have been shown to matter for the wage inequality (Lemieux et al. 2009; Leuven and Oosterbeek 2011; Tang et al. 2020).

Differences in unobserved skills would imply that immigrant workers may have different unobserved (or omitted in the data) skills than native-born workers with the same observed characteristics, which would bias estimates based on the structure of wages for foreign-born and native-born workers (Carnevale et al. 2001; Lemieux 2006; Christl 2020). To address this omitted variable issue, the contribution not only of observable but also unobservable components of the wage dispersion need to be controlled for. Further, movements in the within-group inequality may also reflect market forces changing the returns to (unmeasured) skills. Changes in characteristics affect both the demand and supply of observed and unobserved skills and can alter wage and employment outcomes which ultimately dependents on particular country market conditions (Autor and Katz 1999). The variation of unobserved skills (or those not available in LIS database) among foreign-born and native-born workers across countries may be, among others, due to the cross-country variation in the distribution of the transferability of migrants' experience and education to the host country (e.g. overqualification or underqualification effects), language proficiency, literacy skills, numeracy skills or problem solving skills (Dustmann and van Soest 2002; Himmler and Jäckle (2018).

The *institutional framework* such as the collective wage bargaining can diminish the wage discrimination against minority groups, as usually trade unions tend to present themselves as advocates of "fair pay" for vulnerable groups on the labour market (Plasman et al. 2007; Ohlert et al. 2016; Dostie et al. 2020). Card et al. (2020) find that in the US and Canada unions reduce economy-wide wage inequality by around 10%. Overall, the inequality-reducing effect of minimum wages is often confirmed both for developed and developing economies (Lee 1999; Gerard et al. 2020). For example, Gerard et al. (2020) show that the federally legislated wage floor exerts a strong upward pressure on wages in Brazil, by reducing the effects of firm-specific wage setting and narrowing the wage gap between whites and non-whites. Moreover, trade unions and the minimum wage may reduce wage inequality also through indirect spillover effects on wages of non-union members and higher wage cohorts, respectively (Lee 1999; Dittrich et al. 2011; Laporšek et al. 2019; Fortin et al. 2021), which is particularly relevant for migrants as they often have lower union participation or are employed in the informal sector. Also market imperfections may affect the wage discrimination against migrants, such as the fierceness of competition in labour and product markets. While a concentration of market power in labour and products markets may reinforce wage discrimination against migrants, fierce competition may augment the role of collective wage bargaining for reducing the labour market discrimination (Hirsch and Jahn 2015; Ohlert et al. 2016; Valentine et al. 2021).

The main contribution of this paper is to provide an internationally comparable cross-country, between-group evidence on wage inequality: the earnings of natives in developed countries compared to immigrants (from other developed and from developing countries), and the earning of natives in developing countries compared to immigrants (from other developing and from developed countries). The closest study to ours providing a cross-country evidence on wage differentials and inequality trends between foreign-born and native-born workers is that of Clemens et al. (2019) who estimate the real wage gaps between immigrants in the United States and their observably equivalent national counterparts in 42 home labour markets in developing countries. They calculate the average lower bound on this wage ratio (weighted by the working-age (15–49) population of the home countries) to be 5.7, the ratio exceeding 16 for some developing countries in the sample. While Clemens et al. (2019) focus on the between-country dimension of the global inequality, we estimate the within-country wage inequality of native-born versus immigrant workers and compare the estimated inequalities measures between developed versus developing countries.

Given that the decomposition of global inequality into between-country and within-country inequality is highly sensitive to data measurement issues (Koczan et al. 2021), in the empirical analysis we rely on a large internationally harmonised microdata with 1.5 million individuals (containing both native-born and migrants from developed economies and transition and developing economies), allowing us to estimate the native-migrant wage gap in 21 countries over a 20-year period. In the first step, we apply counterfactual decomposition techniques of Blinder (1973) and Oaxaca (1973) to decompose the native-to-migrant wage inequality in the explained part stemming from differences in productivity-related characteristics and the residual (usually referred to as the unexplained) part. After accounting for a rich set of productivity-related characteristics, 28% and more (depending on the country) of the unexplained wage inequality still remains. In the second step, similarly to Guzi et al. (2015), we provide a narrative evidence of the unexplained gap of native-born wages vis-à-vis immigrants and attempt to relate potential explanations to the four key sets of factors identified

in the literature: group differences in labour force attachment due to labour market discrimination, differences in unobserved job characteristics, differences in unobserved skills, and the institutional labour market framework.

The paper is organised as follows. The next section explains the methodology for the measurement and decomposition of the wage gap between natives and immigrants and the estimation approach of determinants of discrimination. The third section details the data that we use in the empirical analysis and the construction of variables derived from previous studies. The fourth section presents the estimated wage gaps between natives and immigrant. The fifth section discusses the channels of adjustment and mechanics at work, while the last section concludes.

2. EMPIRICAL STRATEGY

We employ the Blinder-Oaxaca (B-O) decomposition technique (Blinder, 1973; Oaxaca, 1973; Oaxaca and Ransom, 1994) to decompose the observed average earnings gap between natives (N) and immigrants (I).[4] The Blinder-Oaxaca decomposition technique has been extensively used in the labour economics literature to study gaps in wages and employment across different groups (e.g., Guzi et al. 2015; Ohlert et al. 2016; Croucher et al. 2018; Ingwersen and Thomsen 2019; Abdullah et al. 2020). The B-O methodology allows to decomposes the mean wage difference in two parts: one that can be explained by group differences in observable human capital factors – intrinsic productivity differences and segregation into labour market categories – and a remainder unexplained part that cannot be accounted for by differences in observable characteristics of migrants and native-born – that is differences in the estimated coefficients.

Our baseline decomposition approach is based on the classical Mincerian wage equation, which is estimated separately for both groups of interest by the Ordinary Least Squares regression:

$$\ln \overline{Wage}_j = \hat{\beta}_j \bar{X}_j, \qquad j \in \{N, I\}. \tag{1}$$

Following the conventional notation (e.g. Jann, 2008) we can write the two-fold decomposition of the native-immigrant wage gap as follows:[5]

$$\ln \overline{Wage}_N - \ln \overline{Wage}_I = \underbrace{(\bar{X}_N - \bar{X}_I)\hat{\beta}_N}_{Explained} + \underbrace{\bar{X}_I(\hat{\beta}_N - \hat{\beta}_I)}_{Unexplained}, \tag{2}$$

where $\ln \overline{Wage}_N$ and $\ln \overline{Wage}_I$ are the native- and immigrant-specific means of the natural logarithm of hourly wages (conditional on being employed), $\bar{X}_N$ and $\bar{X}_I$ represent the respective vectors of mean values of explanatory (Mincerian) variables for natives and immigrants (as

[4] Given that Blinder-Oaxaca may be sensitive to the choice of omitted characteristics making the results difficult to interpret, for robustness we also estimate the Oaxaca-Ransom wage differentials, where we weigh the first term of the decomposition expression using coefficient estimates from a pooled sample of all groups.

[5] In order to ensure representativeness, we consider survey weights in all our microeconomic analyses.

detailed in the Data section). $\hat{\beta}_N$ and $\hat{\beta}_I$ are the corresponding vectors of coefficients estimated from separate regressions for both groups.[6]

As the next step of our decomposition analysis, and to explore the results beyond the mean, we decompose the wage differential between natives (*N*) and immigrant population (*I*) in each country at different quantiles of the wage distribution. To do so we apply unconditional quantile decomposition techniques using Recentred Influence Function (RIF) regressions along with the standard B-O method (Firpo et al., 2009; Fortin et al., 2011). By replacing the variable of interest (in our case hourly wage) with the RIF of a specific percentile, it is possible to link a distributional analysis to a standard regression framework. Given the properties of the RIF, it is possible to model the expected value of the RIF of the percentile of interest as a linear function of a set of covariates:

$$\text{RIF}(lnWage_j, q_\tau) = X_j\beta_j(q_\tau) + u_j, \tag{3}$$

where j is the indicator of the group, q_τ is the τ-quantile of interest, X is a vector of covariates and $\beta_j(q_\tau)$ is a vector of coefficients estimated for the τ-quantile.

Equation (2) can be estimated by the OLS for the respective subpopulation and therefore it is possible to apply the B-O decomposition similarly to decomposition presented in the baseline case and to decompose the difference in the quantile into two additive components, the explained component and the residual component[7]:

$$q_{N\tau} - q_{I\tau} = \underbrace{(\bar{X}_N - \bar{X}_I)\beta_N(q_\tau)}_{Explained} + \underbrace{\bar{X}_I(\beta_N(q_\tau) - \beta_I(q_\tau))}_{Unexplained}. \tag{4}$$

Finally, we follow the framework of Guzi et al. (2015) and corelate the estimated wage differentials (unexplained part of the wage gap) to a set of macro-level contextual variables that are typically considered in the literature to influence earnings at the aggregate level. We do so by estimating a set of bivariate regressions:

$$\chi = \alpha + \phi z + \varepsilon, \qquad \forall z \in Z, \tag{5}$$

where α is a constant, z represents the considered country-level indicator of all the relevant indicators Z (see Appendix A for a detailed description). Coefficient ϕ is of particular interest, capturing the relationship between the unexplained part χ and macroeconomic variable $z \in Z$. The selected country-level observables in Z are not accounted for in the B-O decomposition (i.e. not available in the LIS database) but were identified in the literature to potentially affect earnings differentials between native-born and immigrant workers.

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[6] See Elder et al. (2010) on discussing the pros and cons of different approaches of estimating the unexplained part in the B-O decomposition.

[7] For more details on the empirical implementation of the RIF quantile decomposition, see e.g. Longhi et al. (2013).

3. DATA AND VARIABLE CONSTRUCTION

3.1. Definition of immigrants

Our goal is to study the labour earning of natives in developed countries vis-à-vis comparable immigrants, and the earning of natives in transition and developing economies vis-à-vis comparable immigrants. We define as immigrants all individuals born in a foreign country with respect to the host country (the information on the country of origin is in the Luxembourg Income Study database). Therefore, given our definition, immigrant is equivalent to foreign-born.

3.2. Luxembourg Income Study

Our analysis of inequalities in wages between native and foreign-born population is based on a large survey data obtained from the Luxembourg Income Study (LIS) database[8]. A comparative advantage of the LIS microdata is the broad coverage of a large set of countries across the world and over time and a large set of representative and harmonised variables, making the results directly comparable. The LIS microdata have been used for cross-country studies before, though in different contexts of migration (e.g. Anastossova and Paligorova 2006).

The LIS database is the largest available income database of harmonised microdata collected from more than 50 countries in Europe, North America, Latin America, Africa, Asia, and Australasia spanning over five decades. LIS datasets contain household- and individual-level records, e.g. on the labour income and wages, capital income, social security and private transfers, taxes and contributions, employment, expenditures, and demography. Most importantly, the LIS microdata also contain information on the immigration status of individuals. Unfortunately, not for every country in the LIS database we can observe the immigration status variable and some other crucial covariates necessary for the empirical analysis (e.g. hourly wages earned, employment status, experience, industrial sector, occupation, etc.). After a detailed screening and weighing data paucity trade-offs, we have selected a subset of 21 countries[9] with a complete coverage of the necessary variables, resulting in complete records for more than 1.5 million individuals of which around 150,000 belong to the immigrant population.

To identify structural differences (and similarities) in wage inequality by immigration status across countries, we regroup the 21 sample countries into one of three broad categories following the United Nations World Economic Situation and Prospect (WESP) classification: developed economies, economies in transition and developing economies.[10,11] Following this classification, the developed economies ('developed countries') covered in our paper include: Austria, Canada, Czechia, Estonia, Germany, Greece, Iceland, Ireland, Israel, Italy,

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[8] For more details about the data, see: https://www.lisdatacenter.org/our-data/lis-database/.

[9] Austria, Brazil, Canada, Chile, Czechia, Estonia, Germany, Greece, Guatemala, Iceland, India, Ireland, Israel, Italy, Luxembourg, the Netherlands, Paraguay, South Africa, Spain, Switzerland, and the United States.

[10] https://www.un.org/en/development/desa/policy/wesp/.

[11] The UN designations "developed economies" and "economies in transition and developing economies" are intended for statistical convenience and do not necessarily express a judgement about the stage reached by a particular country or area in the development process.

Luxembourg, Netherlands, Spain, Switzerland and the United States. The economies in transition and developing economies ('developing countries') group includes Brazil, Chile, Guatemala, India, Paraguay and South Africa.

3.3. Variable construction

In the decomposition analysis, our outcome variables of interest are employment (a dummy variable taking the value of 1 if an individual is employed for wage) and the logarithm hourly wage for the working population.[12]

Augmenting the standard Mincerian equation of earnings, we use three sets of explanatory variables, *X*, in the estimation of equations (1) and (3). The first set of explanatory variables relates to intrinsic productivity differences in the value of the human capital or the ability of individuals and includes variables such as education and experience. In the context of immigrants, they have been documented in studies on the language abilities of immigrants (Dustmann and van Soest 2002; Hellerstein and Neumark 2003), literacy skills (Ferrer et al. 2006) or the quality and transferability of foreign education and training (Bratsberg and Ragan 2002). Following the standard decomposition literature (Blinder 1973; Oaxaca 1973), we include age and age squared,[13] gender, education (three categories for low, middle, and high), family composition (number of earners in the household and number of children) as main explanatory variables related to intrinsic productivity of workers. We also consider the number of years since the arrival in the receiving country as an explanatory variable for a robustness check.[14]

A second source of productivity and hence wage differences between natives and immigrants is the labour market segregation, i.e. a non-random sorting of employees into categories with different productivity and hence wages. Among others, Bayard et al. (1999) argue that large parts of the wage gap between whites and non-whites in the USA can be attributed to different types of the labour market segregation. Elliott and Lindley (2008) find that occupational segregation contributes significantly to immigrant-native wage gaps in the UK. The literature proposes a number of characteristics associated with the labour market segregation, including job types, tasks, occupational nomenclatures, firms with different technologies or capital endowments and sectors of activity. Following the decomposition literature, we include the sector of employment and occupation as main explanatory variables.

The formal decomposition analysis is complemented by a narrative evidence – correlation analyses – in an attempt to explain the unexplained wage differences between native-born and immigrants by aggregated macro drivers, *Z,* as specified in equation (5). The aim of this exercise is to complement the information not available in the LIS database (i.e. those drives not account for in explanatory variables, *X*, in B-O equations (1) and (3)) with sources that

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12 For the vast majority of countries, we observe a gross hourly wage, while for Chile, Italy, and Paraguay we can work only with a net hourly wage.

13 In a standard Mincerian equation, the working experience is preferred. However, this information is available only for a small set of countries in the LIS database. Note that for those countries the correlation between experience and age is very strong ($\rho \approx 0.76$), therefore it seems to be justifiable to proxy experience by age.

14 For details on definitions of all microeconomic variables entering decomposition analysis, see Appendix A.

have been identified in the literature to drive wage inequalities between natives and immigrants, i.e. labour market discrimination, differences in unobserved job characteristics, differences in unobserved skills, and the institutional labour market framework (e.g. Carnevale et al. 2001; Lehmer and Ludsteck 2011; Nicodemo and Ramos 2012; Bartolucci 2014; Hirsch and Jahn 2015; Ohlert et al. 2016; Himmler and Jäckle 2018; Christl 2020; Abdullah et al. 2020; Valentine et al. 2021). We construct macro-level explanatory variables combined from a variety of data sources (UN, ILO, OECD, World Bank and others) to proxy for the four sources of variation in the unexplained wage gaps.[15] To account for labour market discrimination we use two indices – the discrimination and violence against minorities and the tolerance for immigrants – constructed based on the Social Progress Index that is available from the Social Progress Imperative (SPI).

As regards unobserved job characteristics, we consider a number of proxies: (i) the ratio of foreign-born to native-born in low skill employment and high skill employment from ILOSTAT, (ii) the ratio of foreign-born to native-born workers with a temporary contract for low-skill workers and for high-skill workers from OECD and (iii) the share of migration in the total population from the United Nations Population Division.[16] To account for unobserved skills we use the following variables: (i) the ratio of foreign-born to native-born overqualification rates form OECD, and (ii) the share of immigrants born in a high-income country from OECD (iii) the ratio of foreign-born to native-born in literacy, numeracy and problem solving indicators from the Programme for the International Assessment of Adult Competencies (PIAAC) database of the OECD, (iv) the ratio of immigrants not speaking the host-country language to those that do, (v) the share of immigrants that are multilingual native speakers.[17] Finally, institutional labour market framework variables considered in the correlation analyses include (i) minimum wage (% of GDP per capita) calculated based on data from ILO (2020) data, database, (ii) coordination of wage-setting index, (iii) government

15 For details on definitions and sources of macro-level explanatory variables see Appendix A.

16 The first set of variables provide an additional description of job characteristics in terms of tasks and duties associated with occupations which is more detailed compared to the occupation variable used in the B-O estimations which controls for the sector of employment (i.e. industry classification). The second set of variables account for inferior (non-standard) forms of employment, which typically feature lower pay and fewer benefits and is more widespread among migrants than natives. The non-standard forms of employment include, among others, temporary employment, part-time work, temporary agency work, seasonal work and dependent self-employment (Hotchkiss and Pitts 2007; ILO 2015, 2016; OECD 2015b; OECD/ILO 2018). With the share of migration in the total population variable we attempt to proxy the complementarity effect between immigrants and native workers in production. The complementarity effect emerges when immigrants and natives are imperfect substitutes in the production process, e.g. due to different skills, occupation segregation, etc., which may lead to raise in demand for complementary production tasks and skills of natives and thus enhance their wage or may rise price competition among migrant workers and exercise a downward pressure on their wages (D'Amuri et al. 2010; Manacorda et al. 2012; Ottaviano and Peri 2012).

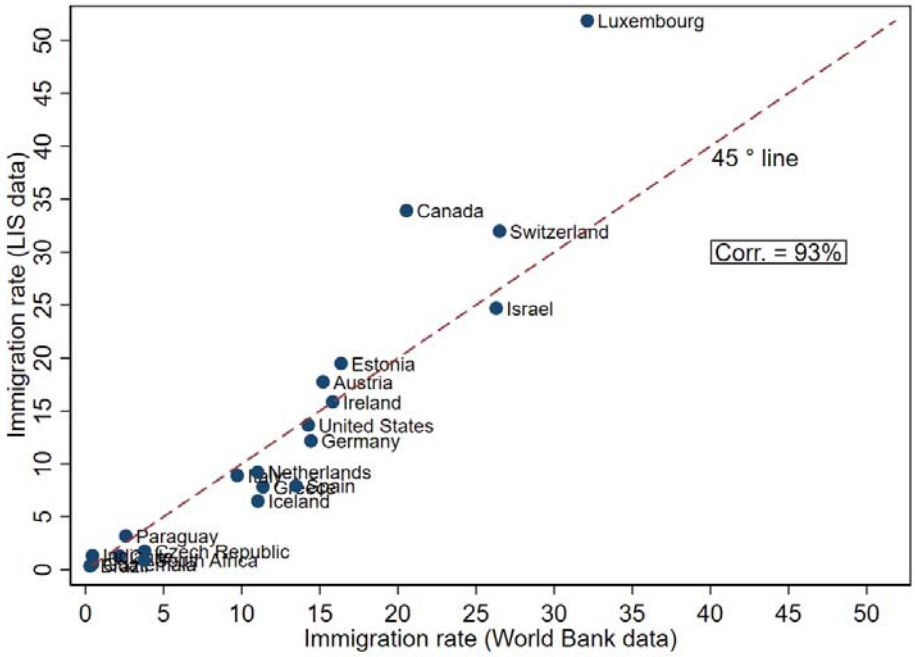
17 The first variable aims to capture imperfect transferability of migrants' skills from their origin to the destination country which is not straightforward to observe or measure in practice and it is usually unavailable in the standard datasets (including in the LIS database). The second variable measures the distance in unobserved skills (e.g. the quality of education and experience) between the labour force in home and host countries. The third variable accounts for unobserved human capital characteristics related to literacy, numeracy and problem solving skills relevant for social and professional performance in the host country. The fourth and fifth variables aim to measure language proficiency of immigrants.

intervention in wage bargaining index and (iv) union density rate all from Visser (2019) and (v) labour market mobility score from the Migrant Integration Policy Index (MIPEX).[18]

3.4. Validity of the LIS migration database

To distinguish between the two labour market groups of interest – natives and immigrants – we use the individual's immigration status in the decomposition analysis. Unfortunately, the LIS data are not representative at the level of immigration status by country. To examine how similar our dataset is to administrative migration data, Figure 1 presents the immigration rates obtained from the LIS database and corresponding figures from the World Development Indicators (WDI) database. By comparing the two data sources, we can conclude that – with the exception of Luxembourg – the immigration rates constructed from the two data bases are highly correlated. Overall, the LIS data appear broadly comparable to administrative migration data, validating the use of the LIS data for our purpose (Figure 1). This also addresses the concern that sensitive information such as the ethnicity or immigration status might be underrepresented in survey-based individual-level data (see, for example, Ciaian et al. 2018).

Figure 1: Immigration rates in the LIS database with the World Bank data (2009/2010)



Notes: LIS figures produced using survey weights.
Source: LIS database; WDI database

To further validate the LIS migration database, we compare the international migrant stocks in the UN censuses data with migrant stocks in LIS survey data. Data on international migrant stocks are extracted from the United Nations Population Division, Trends in Total Migrant Stock, where international migrant stock denotes the number of people born in a country other

[18] The first four indicators attempt to capture the collective bargaining of wages and the minimum wage policies. The last indicator attempts to measure migrants' mobility in the labour market as a proxy of migrants' competition in the labour market.

than that in which they live; it also includes refugees. The UN underlying data used to estimate the international migrant stock at a particular time are obtained from population censuses. The estimates are derived from the data on foreign-born population – people who have residence in one country but were born in another country. When data on the foreign-born population are not available, data on foreign population – that is, people who are citizens of a country other than the country in which they reside – are used as estimates.

As shown in Table B.1 in Appendix B, at the aggregate country-group-level, the LIS data are well comparable to the UN censuses data. For example, in the 2011-2016 period, 68.6% of migrants to developed countries originated from developing countries whereas 31.4% originated from developed countries – according to the LIS data. According to the UN censuses data, the respective shares for the same period were 62.3% and 37.7%, summing up to 100% in both cases (see the last two columns in the first Table in Appendix B). Hence, both numbers are of the same order of magnitude in the LIS and UN data bases. In the same period, 87.3% of migrants to developing countries originated from developing countries and 12.7% originated from developed countries – according to the LIS data. According to the UN censuses data, the respective shares for the same period were 88.1% and 11.9%. Again, both numbers are of the same order of magnitude in the LIS and UN data bases, which provides a further justification for the use of the LIS migration data in our study.

4. ESTIMATED WAGE GAPS

4.1. Raw wage gaps between native-born and foreign-born workers

The Blinder-Oaxaca wage differentials (i.e. total wage gaps including both explained and unexplained part) are reported in Table 1, where the earnings differentials between native-born workers and immigrant workers are expressed in percentage points. First, notice a significant heterogeneity in the native-born/immigrant earnings differentials *between* countries in the LIS sample. For example, whereas in Luxembourg on average native-born workers receive one third higher salary than migrant workers (+30.76%) (migrants are disadvantaged), in Brazil on average native-born workers on average are paid only half of what migrant workers are paid (-48.72%) (migrants are advantaged) (column 1995-2016 in Table 1).

Second, we can observe that the Blinder-Oaxaca wage differentials are strikingly consistent *within* the two country groups ('developed' and 'transition/developing'). The total observed wage gap between the native born and migrant workers is positive and statistically significant for all developed economies in our sample implying that on average, immigrant workers face a wage disadvantage in advanced economies (column 1995-2016 and top panel in Table 1). These results are standard and in line with previous estimates for developed countries which tend to find positive native-to-migrant wage gap (e.g. Chiswick 1978; Baker and Benjamin 1994; Chiswick and Miller 2008; Ludsteck 2011; Van Kerm et al. 2016; Longhi et al. 2013; Ruist 2013, Bertrand and Mullainathan 2004; Smith and Fernandez 2017).

In contrast, the estimated Blinder-Oaxaca wage differentials are negative and statistically significant for all transition and developing economies in the LIS sample, implying that, on average, the relative mean wages of immigrant workers are higher than those of native-born workers (bottom panel in Table 1). The wage disadvantage for native-born vis-à-vis immigrant

workers ranges from -7.7% in India to -48.7% in Brazil. In all six analysed transition and developing economies the wage differentials have been narrowing slightly during the last two decades (compare the last two columns in Table 1). These results are striking though not necessarily surprising. For example, OECD/ILO (2018) have estimated that in South Africa, newly arrived immigrant workers increase the wage gap between native-born and immigrant workers. Gerard et al. (2020) have estimated wage gaps between whites and non-whites natives in Brazil in a range of 27% to 33%.

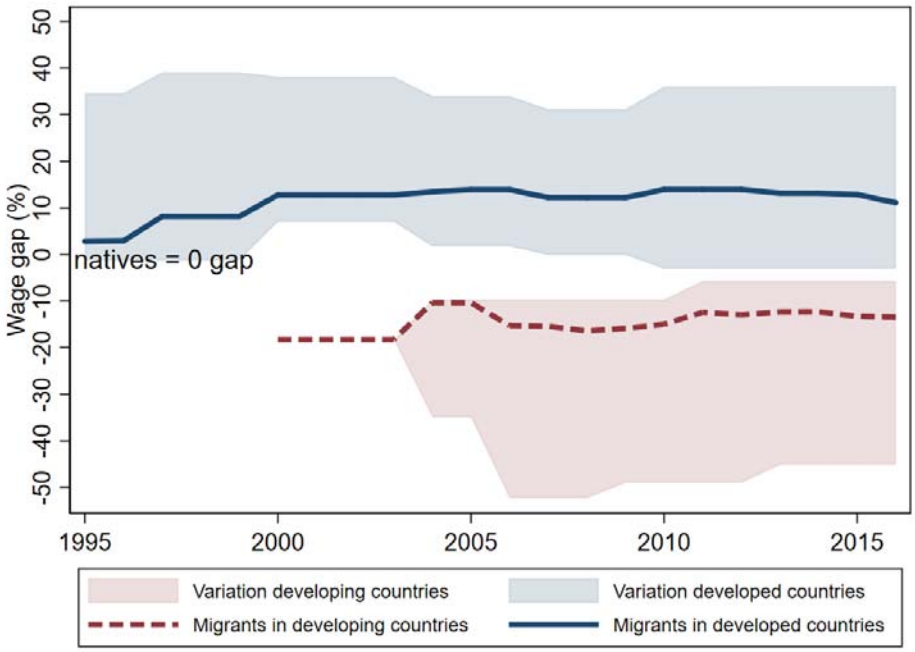
Table 1: Raw native-to-migrant percent wage gap

	Mean wage difference, %			
	1995-2016	1995-2000	2001-2010	2011-2016
Developed economies				
Austria	22.13	23.55	25.24	17.61
Canada	11.55	12.38	12.88	9.41
Czechia	2.40	7.05	3.22	-3.06
Estonia	17.16		28.15	23.33
Germany	7.53	0.74	10.21	11.63
Greece	30.76	34.63	28.16	29.50
Iceland	10.61		11.88	19.94
Ireland	8.82	5.38	5.29	15.79
Israel	12.53		21.94	15.66
Italy	18.83	5.98	22.33	28.17
Luxembourg	34.34	35.91	31.06	36.06
Netherlands	6.27		9.39	9.43
Spain	18.82		23.47	32.98
Switzerland	4.42		7.11	6.14
United States	10.21	10.21	11.38	9.05
Transition and developing economies				
Brazil	-48.72		-51.00	-46.45
Chile	-23.53		-29.43	-17.63
Guatemala	-36.90		-42.53	-31.28
India	-7.69		-9.66	-5.72
Paraguay	-23.85	-18.28	-30.35	-22.91
South Africa	-19.21		-20.37	-18.06

Notes: Missing values imply no LIS data are available for the specific country-period.
Source: Estimated based on Luxembourg Income Study data.

The methodological consistency of the LIS harmonised data across countries and over time allows us to consistently assess both the inter-national and inter-temporal dimension of labour earnings by immigration status. Columns 3-5 in Table 1 and bold lines in Figure 2 report the development of the relative mean wages of immigrant workers vis-à-vis native-born workers during the last two decades. The difference-in-differences perspective suggests that the mean wage gap of immigrant workers vis-à-vis native-born workers has remained largely unchanged in most developed economies (top panel in Table 1). A similar pattern can be observed for most transition and developing economies in our sample – the mean wage differential of immigrant workers vis-à-vis native-born workers has changed (narrowed) little (bottom panel in Table 1). Capturing both dimensions, Figure 2 plots a weighted average of these inequality trends between foreign-born and native-born workers across developed economies (solid line) and economies in transition and developing economies (dashed line). Indeed, the average wage inequality trends (solid and dashed lines in Figure 2) and the cross-country wage dispersion (shaded area in Figure 2) have changed insignificantly during the last 15 years.

Figure 2: Raw native-to-migrant percent wage advantage in developed economies and transition/developing economies



Notes: a positive wage gap indicates the percentage by which the wages of native-born workers exceed those of the foreign-born.
Source: Estimated based on Luxembourg Income Study data for wage gaps and the UN Population Division, Trends in Total Migrant Stock data for migrant population weights used to calculate the mean wage gap for the two country groups.

It is a well-established finding in the literature that the average earnings of immigrants differ from those of natives, with gaps depending, among others, on the migrant country of origin and time spent in the host country. In order to investigate the impact of the length of immigrant stay in the host country, we split our sample into three cohorts: migrants having lived in the host country less than 10 years, 10-15 years and more than 15 years.[19] The estimated native-born/immigrant wage differentials for each cohort are reported in Table 2.

[19] Note that information on years of residence is available only for a subset of countries.

Table 2: Time in the host country and the percent native-to-migrant wage gap

	Mean wage difference, %		
	<10 years	10-15 years	>15 years
Developed economies			
Austria	20.96	18.16	12.93
Canada	26.87	18.74	1.00
Estonia	4.61	8.64	26.53
Germany	28.98	20.75	2.35
Greece	50.29	33.59	19.07
Ireland	12.22	14.16	4.56
Israel	53.89	32.42	0.71
Italy	35.57	28.27	15.01
Luxembourg	37.05	35.10	25.54
Switzerland	5.36	6.80	7.27
United States	26.12	15.27	-4.24
Transition and developing economies			
Chile	-12.11	-20.19	-34.45
Guatemala	-4.06	-44.36	-14.35
South Africa	-35.05	-0.62	-16.84

Notes: Missing data on the immigrant time in the host country for Brazil, Czechia, Iceland, India, Netherlands, Paraguay, Spain.
Source: Estimated based on Luxembourg Income Study data.

The wage differentials by the time migrants have spent in the host country suggest a sizeable heterogeneity in Table 2. Both the sign and magnitude of the impact of the time spent in the host country on wage differentials between native-born and migrant workers differ substantially *between* our sample countries. In the same time, we can observe a remarkably consistent pattern *within* the *developed country* sub-sample (Austria, Canada, Germany, Greece, Ireland, Israel, Italy, Luxembourg, United States), where the relative mean wages of immigrants vis-à-vis the native-born decrease in the time spent in the host countries. Estonia and Switzerland are the only developed economies in our sample where the native/immigrant wage differentials are widening – even after longer time periods spent in the host country the immigrant wage disadvantage remains substantial, suggesting that integration may be more challenging for foreigners in Estonia (mainly Russian-speaking immigrants refusing to integrate for ideological reasons, see, e.g. Kielyte and Kancs 2002) and Switzerland (which is known for its tough stance on immigrants) compared to other developed economies (see, e.g. Hainmueller and Hangartner 2013).[20] In contrast, the wage gap does not seem to be decreasing in the time immigrants have spent in the host transition and developing economies (Chile, Guatemala, South Africa).

4.2. Unexplained wage gap

We expect that a significant part of differences in labour market outcomes between heterogenous groups of workers can be explained by productivity differences. In the Blinder-Oaxaca decomposition, we control for two sources of productivity differentials between immigrants and native-born: intrinsic productivity differences between immigrants and native-

[20] Hainmueller and Hangartner (2013) document the immigrant discrimination and foreigner integration difficulties in Switzerland using a natural experiment.

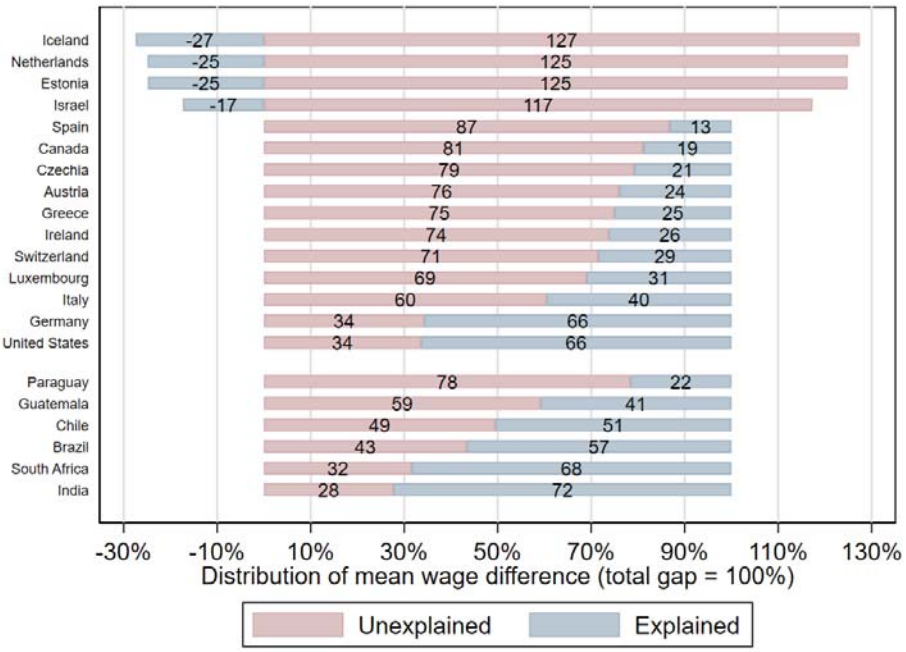
born within the same category (age, gender, education, experience, family composition) and segregation into labour market categories with a differentiated productivity (sector of employment, occupation). Controlling for productivity differences, yields a robust estimate of the explained part of the Blinder-Oaxaca wage differentials. The residual (unexplained) wage gaps between native-born and immigrants and its development over time, after controlling for the observable intrinsic and segregation related characteristics in the Blinder-Oaxaca estimations are reported in Table 3. Figure 3 displays the size (share) of the unexplained wage gap relative to the total wage gap and in comparison with the explained gap.

Table 3: Native-to-migrant percent unexplained wage gap after controlling for productivity differentials

	Mean wage difference, %			
	1995-2016	1995-2000	2001-2010	2011-2016
Developed economies				
Austria	16.81	19.34	17.92	13.18
Canada	9.37	10.49	10.64	6.97
Czechia	1.90	4.95	2.01	-1.25
Estonia	21.42		23.40	19.44
Germany	2.58	-0.49	3.03	5.20
Greece	23.05	31.31	20.71	17.14
Iceland	13.52		9.83	17.20
Ireland	6.50	2.46	4.48	12.56
Israel	14.70		17.41	11.99
Italy	11.39	4.88	11.74	17.56
Luxembourg	23.67	19.36	21.96	29.68
Netherlands	7.83		7.88	7.78
Spain	16.33		15.52	17.14
Switzerland	3.16		3.10	3.22
United States	3.43	2.95	3.54	3.79
Transition and developing economies				
Brazil	-21.13		-20.35	-21.91
Chile	-11.64		-14.81	-8.47
Guatemala	-21.83		-28.53	-15.13
India	-2.13		-2.08	-2.17
Paraguay	-18.69	-13.29	-23.27	-19.51
South Africa	-6.07		-1.04	-11.09

Notes: Missing values imply no LIS data are available for the specific country-period.
Source: Estimated based on Luxembourg Income Study data.

Figure 3: Distribution of explained and unexplained wage differentials (at the mean) between natives and immigrants across countries (1995-2016, total gap = 100%)

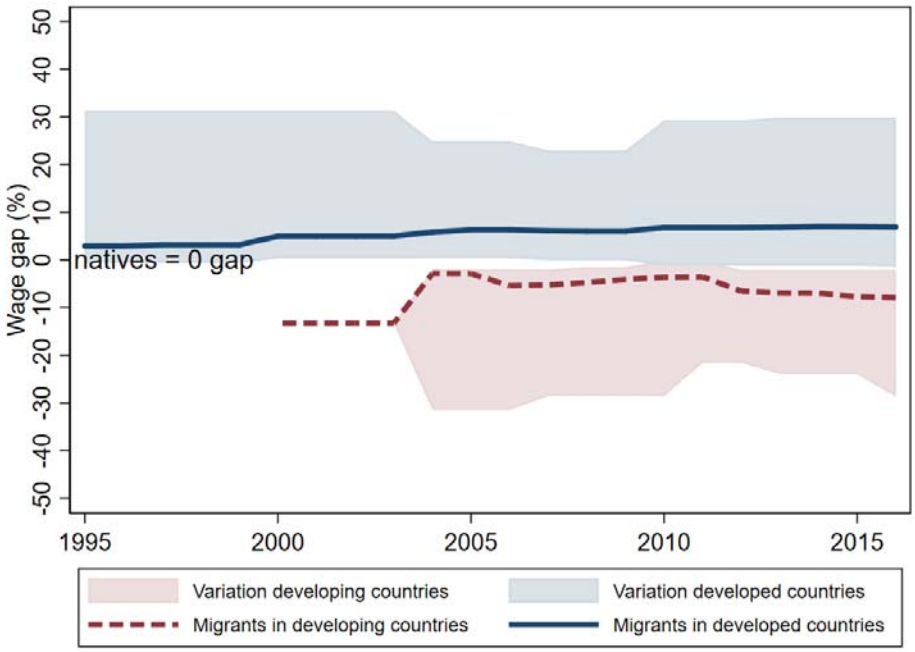


Note: Distribution of wage gaps are sorted according to the size (share) of unexplained wage gap within the two country groups.
Source: Estimated based on Luxembourg Income Study data.

The Blinder-Oaxaca decomposition results suggest that, after controlling for productivity differentials, the native-to-migrant percent wage advantage has declined in most countries in the LIS sample. The exceptions are Iceland, the Netherlands, Estonia and Israel where the productivity differentials (the explained wage gaps) tend to magnify the immigrant worker wage advantage relative to the native-born workers, while the unexplained wage gap exceeds the total wage gap (compare Table 1 and Table 3; Figure 3). Overall, the unexplained wage gap remains sizeable in most countries even after controlling for productivity differentials. Its share in the total wage gap varies between 34% and 127% in developed countries and between 28% and 78% in transition and developing economies. With few exceptions (i.e. Germany, United States, Paraguay), the share of the unexplained wage gap in the total wage gap is greater in developed economies than in transition/developing economies (Figure 3).

We can observe a sizeable heterogeneity in the magnitude of the unexplained wage gap across the LIS sample countries (column '1995-2016' in Table 3), the cross-country heterogeneity being persistent both *between* and *within* country groups. The unexplained wage gap remains positive for most developed economies and negative for all studied transition and developing economies. That is, the unexplained factors (the unexplained wage gap) cause that mean wages of immigrant workers to be lower (higher) than those of the native-born workers in developed countries (transition and developing economies). Figure 4 plots the weighted average unexplained inequality trends between foreign-born and native-born workers for developed economies (solid line) and transition and developing economies (dashed line). The unexplained wage inequality trends (lines in Figure 4) and the cross-country wage dispersion (shaded areas in Figure 4) has increased slightly during the last decade.

Figure 4: Native-to-migrant percent unexplained wage gap after controlling for productivity differentials in developed economies and transition/developing economies



Notes: a positive wage gap indicates the percentage by which the wages of native-born workers exceed those of the foreign-born.
Source; Luxembourg Income Study data for wage gaps and the UN Population Division, Trends in Total Migrant Stock data for migrant population weights used to calculate the mean wage gap for the two country groups.

Overall, Table 3 and Figure 4 suggest that vis-à-vis workers born in developed economies, the workers born in transition and developing economies are disadvantaged both in their home country labour markets and – if migrating – also in developed host country labour markets. The opposite is true for workers born in developed countries – the estimated Blinder-Oaxaca unexplained wage differentials are positive (negative) vis-à-vis workers born in developing economies in home country (in transition and developing economies) in Table 3 and Figure 4.

5. DISCUSSION AND MECHANISMS

We have established that productivity differences between immigrants and native-born within the same type of jobs and overrepresentation of immigrants in certain labour market categories with different productivity/wage characteristics can explain different shares of the observed mean wage differences even across countries with a comparable wage structure. This implies that other sources of wage differentiation must be present given the persistence of the unexplained wage inequalities. In this section we briefly review the literature, by focusing particularly on the labour market discrimination, unobserved job characteristics, unobserved skills and the institutional framework.

5.1. Labour market discrimination

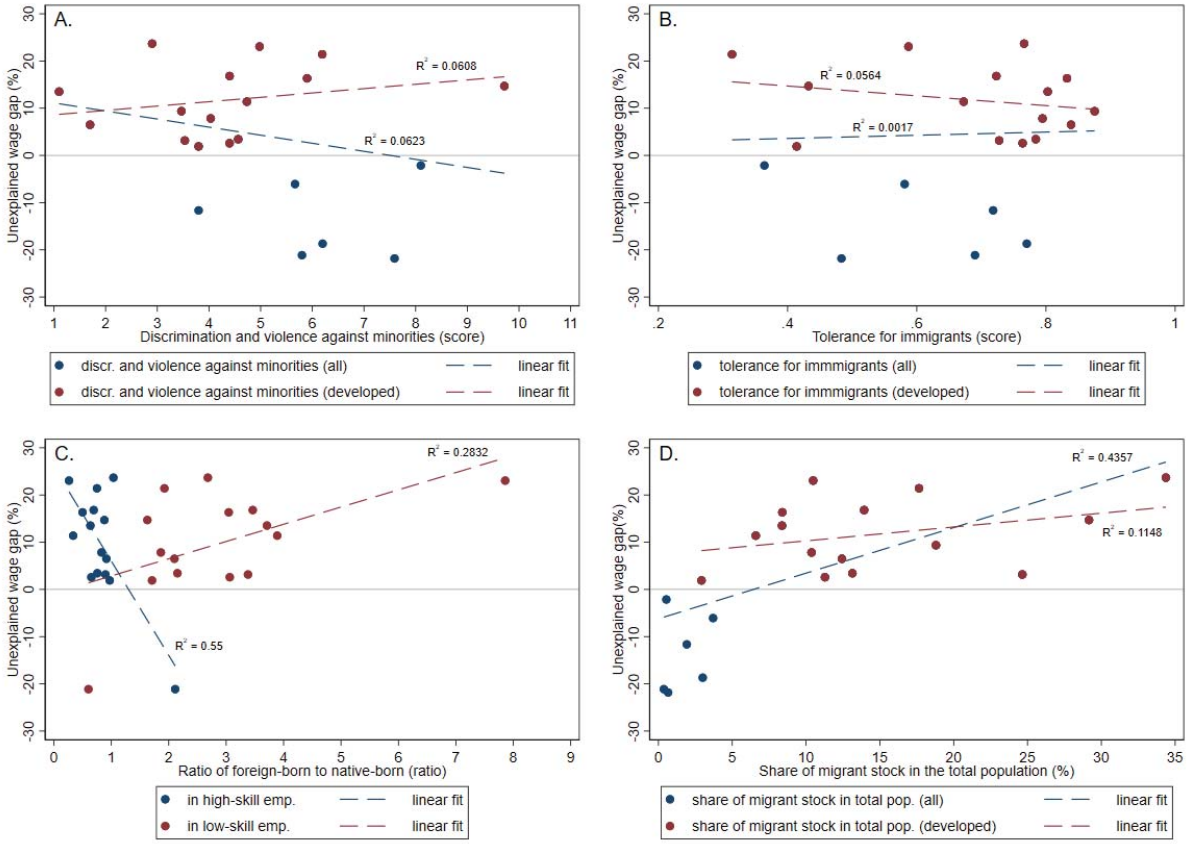
The unexplained part of the native-to-migrant wage gap is usually interpreted as discrimination against the disadvantaged group, on the assumption that the characteristics controlled for in the estimation accurately capture (observed and unobserved) individuals' productivities (Lehmer and Ludsteck 2011; Bartolucci 2014; Abdullah et al. 2020). According to Heckman (1998, p. 102), "*if an otherwise identical person is treated differently by virtue of that person's race or gender, and race and gender by themselves have no direct effect on productivity, discrimination is said to arise*." Several alternative explanations have been proposed in the literature attempting to explain the rationale for discrimination: "taste- or preference-based discrimination" (Becker 1971), "statistical discrimination" (Phelps 1972; Arrow 1972), social interactions and network theory (Montgomery 1991) and others.

Two facts are worth to notice in the context of our analysis. First, depending on the fieriness of competition on output markets, the native-to-migrant wage discrimination is possible in imperfectly competitive markets (taste-based discrimination) or also in competitive product markets (the statistical discrimination and social interactions and networks theories). Second, note that all three discrimination theories may aid us explaining both positive and negative unexplained wage gaps between natives and migrants as it is estimated in Table 3. For example, natives may receive inferior wage to migrants despite having equal productivities if employers assign positive utility to migrants (in the case taste-based discrimination theory), if migrants have mean statistical productivity higher than natives (for the statistical discrimination theory) or if natives have better developed social and professional networks (for the social interactions and networks theory).

To explore whether the mainstream society's attitudes towards minorities and the wage gap are related, in Figure 5 (panels A and B) we compare the unexplained wage gap reported in Table 3 and the discrimination and violence against minorities and the tolerance for immigrants indices. The discrimination and violence index against minorities shows a negative correlation with the unexplained wage gap in panel A, while the tolerance index for immigrants does not seem to be correlated across developed economies and transition/developing economies in panel B . However, when considering only developed countries, the corelations become slightly positive and negative for the first and the second index, respectively (not shown in Figure 5). This could suggest the presence of some discrimination in developed countries where the native-migrant unexplained wage is positive. In transition and developing economies the unexplained wage gap is negative, so the discrimination (if present) seems not to be reflected in labour markets (at least in terms of wage). Because of relatively low correlations, it is difficult to determine whether migrant discrimination on labour markets causes higher levels of wage gap, or whether some omitted variables determine both discrimination/tolerance indices and wage gaps (e.g. the downstream demand). Also, the measurement error could be an issue – the discrimination/tolerance index's accuracy in capturing the discrimination in labour markets (compared to society as a whole).

The presented narrative evidence rejects the discrimination hypothesis, implying that accounting solely for the labour market discrimination we may not be able to explain much of the observed cross-country variation in the unexplained wage gap between natives and migrants.

Figure 5: Correlations between the unexplained wage gap and discrimination (A, B) and job characteristics (C, D)



Source: Unexplained wage gaps estimated based on Luxembourg Income Study data as reported in Table 3; the Discrimination and violence against minorities score (panel A) and the tolerance for immigrants score (panel B) from the Social Progress Imperative, and the Social Progress Index, (http://www.socialprogressindex.com/resources) calculated as average values over the available years between 2004-2016; the ratios of foreign-born to native-born in low skill employment and high skill employment are from ILOSTAT, International labour migration statistics (ILMS) (https://ilostat.ilo.org/topics/labour-migration/) and are calculated as average values over the available years between 2010-2016 (panel C); the share of migrant stock in the total population is average for 1995-2015 extracted from the International migrant stock 2019 - United Nations Population Division (panel D).

5.2. Job characteristics

A further source of the unexplained wage gap variation across countries has been attributed to differences in unobserved job characteristics or omitted variables in the underlying data, as is the case of the LIS. Indeed, there is a growing evidence that firms matter for worker earnings. In a survey of the empirical literature concerned with estimation of worker and firm fixed effects on earnings, Card et al. (2018) find that firm effects explain around 20% of the variation in worker earnings; employers are heterogeneous in some innate characteristics – productivity, amenities and networks to other firms, for example – and this heterogeneity is then passed through into differences in earnings of otherwise similar workers. García-Pérez et al. (2014) show for Spain that, when controlling for firm characteristics (e.g. those linked to specific firm's job requirements and production process), wage inequalities between natives and

immigrants decrease significantly compared to baseline estimations without controlling for the unobserved firm heterogeneity. Similarly, Nicodemo and Ramos (2012) report that the immigrants segregation into low-pay occupations/jobs is one of the key causes for the observed wage gap between native and immigrant female workers in Spain. Caunedo et al. (2021) document systematic cross-country differences in task intensity of an occupation across 42 countries and find that developed countries use non-routine analytical and interpersonal tasks more intensively than developing countries, but less intensively use routine-cognitive and routine-manual tasks.

To investigate whether job characteristics and native-migrant pay differences are related, we corelate ILOSTAT data for the employment distribution between native-born and foreign-born workers by the occupation type accounting for skill levels with the unexplained wage gap. Indeed, Figure 5 (panel C) shows that the unexplained wage gap is positively correlated with the ratio of the share of foreign-born to native-born in low-skill employment but negatively correlated with the ratio of high-skill employment. That is, the unexplained wage gap increases (decreases) if the share of migrants in low (high) skill jobs increases compared to the respective share of natives. Although, we are unable to interpret these correlations as causal because both the composition and attrition of the job-worker pairs are not random, they provide a suggestive evidence that differences between native worker jobs and migrant worker jobs may explain part of the observed wage gap.

Other job characteristics that differ systematically between native-born and migrant workers include the incidence of inferior (non-standard) forms of employment, which typically feature lower pay and fewer benefits. According to ILO (2016) data, non-standard forms of employment are considerably more widespread among migrants than natives. For example, on average 13% of employed immigrants had a temporary contract in OECD countries in 2012-2013, though the native-migrant-worker gap in temporary contracts is varying considerably across countries: it varies between around -7% in Turkey and more than 15% in Cyprus and Spain (OECD 2015a). To explore whether the incidence of inferior jobs and the native-migrant pay differences are related, we corelate the unexplained wage gap and the ratio of foreign-born to native-born workers with a temporary contract. The results suggest a positive correlation between the unexplained wage gap and jobs with a temporary contract and the correlation seems to be stronger for high-skill workers than for low-skill workers (see Figure C.1 in Appendix C). This correlative effect of the job inferiority on pay disadvantage can be interpreted as an overrepresentation of migrants in inferior jobs, which typically feature lower pay and lower job security.

Further, the literature has shown that often there are important complementarities between immigrant and native-born workers in production (D'Amuri et al. 2010; Manacorda et al. 2012; Ottaviano and Peri 2012). The immigrant-native worker complementarity effect is expected to boost productivity and demand for complementary production tasks and skills of native workers, thus enhancing their wage. In contrast, price competition among migrant workers may exercise a downward pressure on migrant wages. When migrant and native workers are close substitutes, an increase in supply of immigrants is expected to be associated with the increase in the immigrant-native wage gap. If the immigrant-native worker complementarity effect and/or price (wage) competition effect differs across skills, it may lead to a variation in the unexplained migrant-native wage gap across countries. The net effect is shown in Figure 5 (panel D), which suggests a positive and significant correlation between the share of

immigrants in the total population and the unexplained wage gap. The correlation is stronger when considering all selected countries as compared when including only developed countries. This result can be interpreted as positive complementarities between immigrant workers and native worker in the production process and/or price (wage) competition between (perfectly) substitutable migrant workers.

Overall, the presented evidence – supported by previous literature findings – implies that including job characteristics among explanatory variables may explain a significant part of the cross-country variation in the unexplained wage gap between natives and migrants.

5.3. Unobserved skills

The literature argues that an important source of the migrant-to-native wage gap is differences in unobserved skills between migrant and native workers, which may have equal observed characteristics. The unobserved skills may vary systematically between native-born workers and migrant workers due to a number of reasons such as imperfect transferability of migrants' skills acquired in the home country, the distance in unobserved skills between the labour force in home and host countries, unobserved human capital characteristics (literacy, numeracy and problem-solving skills), or discrepancies in migrants' language proficiency (e.g. Dustmann and van Soest 2002; Bratsberg et al. 2006; Izquierdo et al. 2009; Lehmer and Ludsteck 2011; Himmler and Jäckle 2018; Christl 2020; Valentine et al. 2021).

The proportion of skills that migrants can transfer and employ in the host country determine their initial wage. The transferability of migrants' skills (education and experience) is imperfect, among others, because of differences in education systems, the quality of education as well as due to differences in specific technical, hard and soft skills required in home and host countries, imperfect comparability between qualifications obtained in different countries, limited skill recognition, and others. Due to of imperfect transferability of migrants' skills from their home to the host country, migrants' education and experience acquired in the home country may fail to signal the true qualifications and serve an effective screening device of migrants' skills to employers in the host country. This in turn may increase the statistical discrimination discussed in section 5.1 (ILO 2016).

A cross-country variation in the proportion of skills that migrants can transfer to the host country may thus cause a variation in the unexplained native-to-migrant wage gap across host countries. For example, OECD (2015a) data indicate consistently higher overqualification rates of foreign-born as compared to native-born workers in OECD countries;[21] the average share of overqualified workers for their current job being 35% for foreign-born versus 28% for native-born. The difference in the overqualification rates between immigrants and natives is greater than 5% in most OECD countries and varies between -5% in Slovakia and more than 25% in Greece, Iceland and Italy. This cross-country variation in overqualification rates may partially explain the variation of the unexplained wage gap across countries. Figure 6 (panel A) confirms

[21] The overqualification rate is defined as the percentage of workers with formal tertiary-level education who work in a job that is classified as low- or medium-skilled (OECD 2015a).

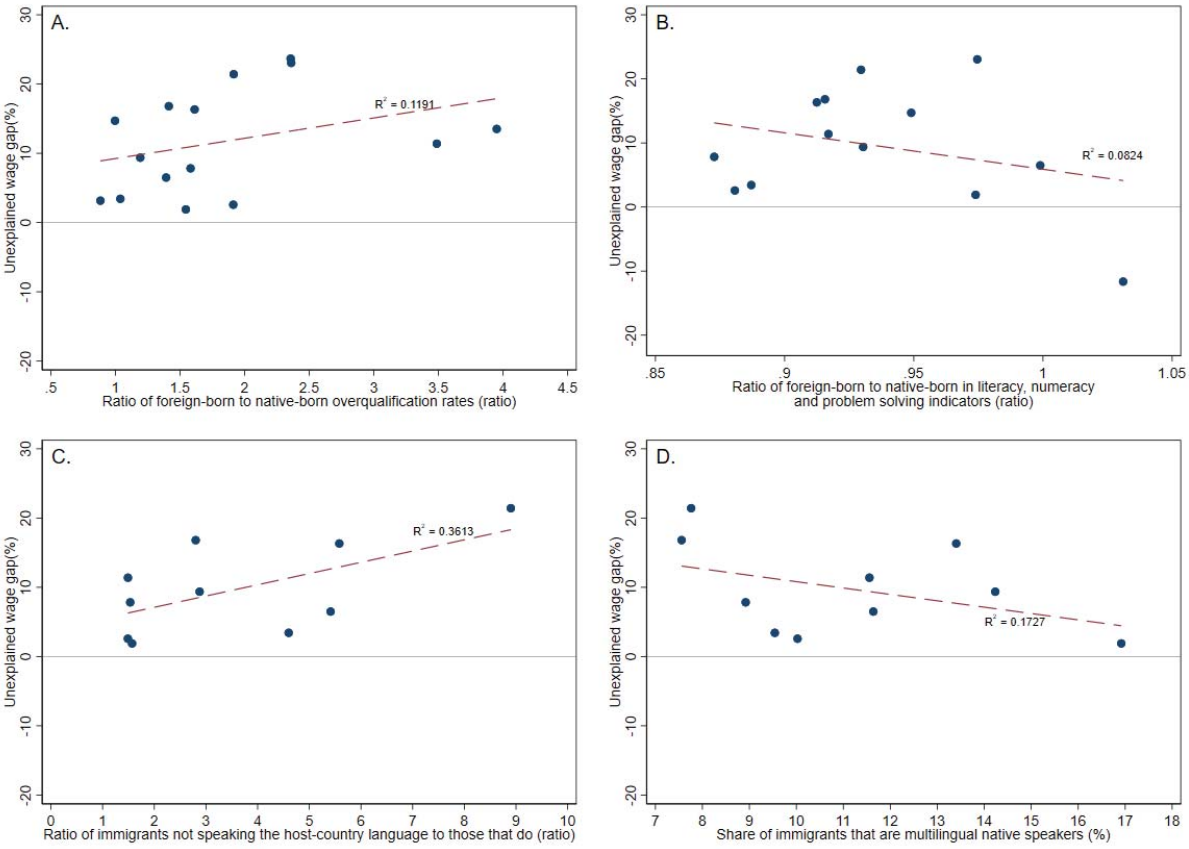
that indeed there is a positive correlation between the unexplained wage gap and the ratio of foreign-born to native-born overqualification rates in developed countries.

Issues with the transferability, comparability and recognition of formal and informal skills are present also in developing countries (OECD/ILO 2018). For example, the overqualification of immigrants is found also in developing countries though it is not necessarily greater than that for natives. In contrast, migrant workers are more likely to be underqualified than native workers. The difference in the overqualification rates between foreign-born and native-born varies between around -12% in Kyrgyzstan and around 7% in Rwanda but is negative (smaller for migrants) in most developing countries (OECD/ILO 2018). In contrast, underqualification rates are higher for foreign-born workers than native-born in most of the 10 countries studied by the OECD/ILO (2018) with the migrant-native difference varying between -34% in Rwanda and 17% in the Dominican Republic. Lower overqualification rates and higher underqualification rates for migrant workers than for native workers may partially explain the negative unexplained wage gaps in developing countries reported in Table 3. Lower overqualification rates for migrants than for natives in developing countries imply that migrant workers are less likely to be employed in inferior jobs (and receive lower wage) relative to their attained education as compared to native-born workers in developing countries. In contrast, because of higher underqualification rates among migrants in developing countries, migrant workers are more likely to get a superior job (and receive higher wage) relative to their education level compared to native-born workers in developing countries.

The wage gap in the host country may be larger or smaller, depending on the migrant's country of origin (Izquierdo et al. 2009; Lehmer and Ludsteck 2011; Valentine et al. 2021). This heterogeneity is usually attributed to the distance in unobserved skills (e.g. the quality of education and experience) between the labour force in home and host countries. For example, Nicodemo and Ramos (2012) find that the wage gap between native and immigrant female workers in Spain is larger for immigrants from developing countries, but relatively small or non-existent for migrant workers from developed countries. Similarly, Lehmer and Ludsteck (2011) find a considerable heterogeneity in wage gaps between migrants from different nationality groups in Germany.

To investigate whether variation in unobserved skills and pay gap are related, we plot correlation between the unexplained wage gap and the share of immigrants born in a developed country. The correlation appears negative for OECD countries which is contrary to our expectations, given that migrants from developed countries are expected to have higher quality education and experience vis-à-vis migrants from developing countries (see in Figure C.2 in Appendix C). However, from these descriptive results, it is difficult to determine whether higher proportion of migrants from developed countries reduces the unexplained wage gap, or whether some omitted variables determine both the distance in unobserved skills and pay gap.

Figure 6: Correlations between the unexplained wage gap and unobserved skills



Source: Unexplained wage gaps estimated based on Luxembourg Income Study data as reported in Table 3; the ratio of foreign-born to native-born overqualification rates are from OECD (2015a) and are calculated as average values over the available years between 2012-2013 (panel A); the ratio of foreign-born to native-born in literacy, numeracy and problem-solving indicators is calculated based on OECD PIAAC data for 2012 (panel B); the ratio of immigrants not speaking the host-country language to those that do is calculated based on 2012 data from OECD (2015a) (panel C); the share of immigrants that are multilingual native speakers for 2012 is extracted from OECD (2015a) (panel D).

The unobserved worker skills can be measured in terms of literacy skills, numeracy skills and problem-solving skills which capture human capital characteristics (e.g. communication and analytical abilities) relevant for social and professional performance in the host country. According to OECD PIAAC data, foreign-born individuals show lower performance as compared to native-born individuals in these three competences in most OECD and non-OCED countries covered in the LIS data. For example, Himmler and Jäckle (2018) and Christl (2020) find that differences in the literacy proficiency explain a substantial part of the wage gap between natives and immigrants in Germany and Austria, respectively. Figure 6 (panel B) seems to confirm a positive correlation between the gap in the literacy, numeracy and problem-solving skills, and the unexplained wage gap, suggesting that differences in these unobserved skills may contribute to the observed pay gap between native born and migrant workers. Similarly, the empirical literature suggests that migrant-native discrepancies in language proficiency is an important cause of wage inequalities (Carnevale et al. 2001; Dustmann and van Soest 2002). Leveraging OECD data on language abilities of immigrants, also Figure 6 (panels C and D) confirm the positive correlation between the unexplained wage gap and language skills of migrants in OECD countries. Overall, this evidence suggests that migrants'

knowledge of the host-country's language (panel C) and migrants' multilingual skills (panel D) reduce the wage differential with respect to natives.

The experience and education obtained in the host country may address the skill transferability and recognition issues associated with experience and education acquired in the migrant home country (e.g. reduce the statistical discrimination). They may serve as more effective screening devices of migrants' skills to employers in the developed host country and hence narrow the pay gap. According to OECD (2015a), highly educated immigrants who have acquired education in the host country are less likely to be overqualified in their job than those that acquired education the migrant home country. Indeed, the evidence suggests that the wage gap tends to decrease with the length of migrants' work experience / residence in the host country because of the accumulation of human capital specific to the host country's labour market needs (Bratsberg et al. 2006; Izquierdo et al. 2009). For example, Valentine et al. (2021) estimate for Belgium that the migrant-native wage gap tends to disappear with the migrants' accumulation of firm-specific labour market experience. Similarly, Izquierdo et al. (2009) find for Spain that the initial wage differential relative to natives halves within five to six years of residence, although it never disappears completely.

To explore whether experience / residence in the host country and pay gap are related, in Table 4 we report the time spent in the host country and the unexplained wage gap. Blinder-Oaxaca estimates reported in Table 4 suggest that the unexplained wage gap decreases with the time migrants have spent in the host country – in line with findings in the previous literature. The estimated unexplained wage gap is around 50% to 70% of the corresponding raw estimates reported in Table 2. However, we are unable to interpret these correlations as causal because both the composition and attrition of migrants' human capital from developing and developed countries are not random in the host country. To identify a causal relationship, an exogenous variation in the human capital accumulated in developing and developed countries would be required.

Table 4: Time in the host country and percent unexplained wage gap

	Mean wage difference, %		
	<10 years	10-15 years	>15 years
Developed economies			
Austria	12.93	9.30	6.59
Canada	16.34	11.88	0.56
Estonia	2.89	4.36	16.61
Germany	15.97	12.72	1.59
Greece	27.76	17.77	12.89
Ireland	6.17	7.12	2.84
Israel	28.62	18.71	0.50
Italy	18.75	17.98	8.09
Luxembourg	21.27	19.97	17.70
Switzerland	3.47	4.06	4.26
United States	15.83	10.26	2.90
Transition and developing economies			
Chile	-8.40	-13.55	-20.67
Guatemala	-2.38	-23.47	-9.70
South Africa	-19.84	-0.41	-9.41

Notes: Missing data on the immigrant time in the host country for Brazil, Czechia, Iceland, India, Netherlands, Paraguay, Spain.
Source: Estimated based on Luxembourg Income Study data.

We may conclude that the variation of unobserved skills among foreign-born and native-born workers across countries, such as variation in the distribution of the transferability of migrants' experience and education to the host country (e.g. overqualification or underqualification effects), language proficiency, literacy skills, numeracy skills or problem solving skills, may explain a significant part of the cross-country variation in the unexplained wage gap between natives and migrants. The presented evidence is supported by previous literature findings.

5.4. Institutional framework

Variation in the institutional framework across countries might be an important source of cross-country differences in migrant wage disadvantage vis-à-vis natives, because formal and informal institutions affect the functioning and outcomes of labour markets. Literature argues that important institutional drivers potentially affecting the wage discrimination between migrants and natives through both quantity and price channels are the collective bargaining of wages and the minimum wage policy. Further, the effectiveness of the collective wage bargaining and the minimum wage policy depends on the fierceness of competition in output and labour markets (e.g. DiNardo et al. 1996; Plasman et al. 2007; Hirsch and Jahn 2015; Kampelmann and Rycx 2016; Ohlert et al. 2016). With few exceptions (e.g.; Ohlert et al. 2016; Valentine et al. 2021), these institutional factors are not accounted for in most empirical studies, as it is not straightforward to measure them empirically and identify their effects under reasonable assumptions.

The existing empirical evidence in the literature confirms that wage discrimination is lower in countries/regions with a collective bargaining framework (e.g. Plasman et al. 2007; Ohlert et al. 2016). A collective bargaining of wages is found to diminish the wage discrimination against minority groups, as trade unions tend to present themselves as advocates of "fair pay" for vulnerable groups on the labour market (Card et al. 2020; Gerard et al. 2020). Similarly, also the minimum wage policy is found to decrease the wage gap between migrants and natives by particularly affecting low wage worker groups (Butcher and Dinardo 2002).

Both trade unions and the minimum wage may reduce native-to-migrant wage gaps also through indirect spillover effects on wages of non-union members and workers that have wage above the minimum wage, respectively. This effect is particularly pertinent for immigrants, given that they often feature lower union participation rates or are employed in the informal sector due to irregular residence status thus benefiting less from the formal employment protection legislation in the host country (including minimum wage) (ILO 2015, 2016; OECD/ILO 2018). In addition, the unionisation spillover effect may cause a wage-equalising effect on non-union members through the "threat effect" by incentivising non-union employers to emulate the union work conditions (including wage) to discourage workers from supporting unionisation. The minimum wage spillover effect on high skill workers, among others, may be a result of the substitution effect as the raise of the relative costs of low-skill labour induced by a minimum wage may lead to higher demand for high-skill labour or may be due to increasing

reservation wages of certain types of workers (Lee 1999; Dittrich et al. 2011; Laporšek et al. 2019; Fortin et al. 2021).[22]

When employers have a certain bargaining power on the product market, a taste-based wage discrimination against minorities is more likely to occur (Becker's 1971). Because discrimination is costly (as discriminating implies paying wages above the marginal revenue product to the privileged group of workers), fiercer product market competition limits the scope for a wage discrimination. Further, a wage discrimination against immigrants can also be an outcome of a limited competition on labour markets (e.g. in the presence of few employers demanding migrants' labour) even with a perfect product market competition. This may occur particularly when migrant workers have lower job mobility or when they have lower elasticity of labour supply with respect to wage compared to natives (Cain 1987; Manning 2003; Hirsch and Jahn 2015; Ohlert et al. 2016).[23] Indeed, migrants are often found to have reduced mobility on labour markets due to their irregular legal status (e.g. without a residence permit), have lower social capital and professional networks specific to the host country which restricts them to access information about job opportunities or reduces their bargaining power vis-à-vis employers. Thus, migrant dependency on a specific employer or employment agencies (e.g. temporary work agencies) is usually stronger compared to natives (ILO 2016).

Empirical studies provide evidence that indeed a competitive pressure on product and labour markets reduces the unexplained wage gap between immigrants and natives which supports the Becker's hypothesis of a negative relationship between the competition intensity and wage differentials (Hirsch and Jahn 2015; Ohlert et al. 2016; Valentine et al. 2021). The estimates of Ohlert et al. (2016) for Germany suggest that there is an interplay between the fierceness of competition and the collective bargaining – the role of competition in output markets in reducing a wage discrimination is larger in the absence of a collective wage bargaining. In other words, the effect of a collective bargaining on reducing wage inequalities is magnified by a limited competition in product markets.

To explore whether the institutional framework and migrant-native pay gap are related, in Figure 7 (panel A) we correlate the unexplained wage gap and the minimum wage expressed

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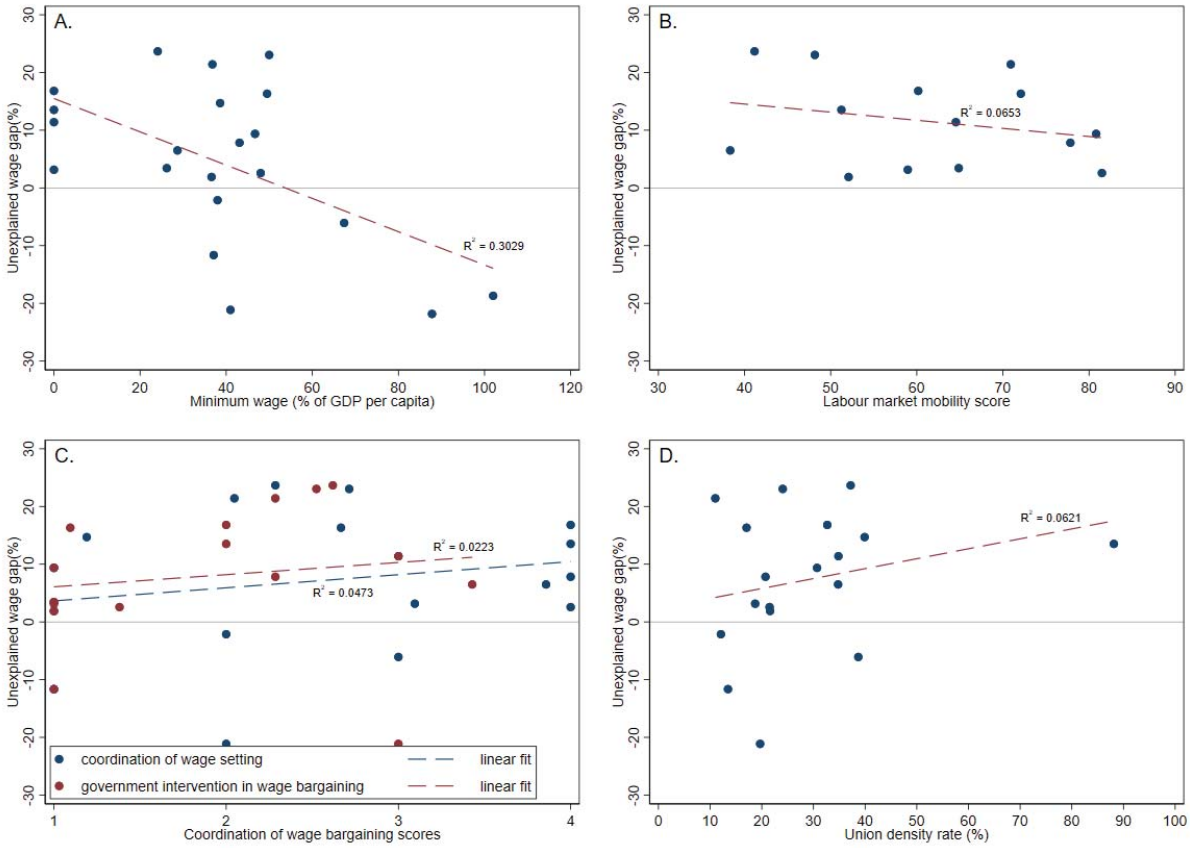
[22] Note that the impact of the minimum wage spillover effect on the native-to-migrant wage gap is not straightforward. Whether it reduces the wage inequality depends on (i) the difference between the direct impact of minimum wage on low wages *versus* the indirect spillover effect on wages in the upper tail of the wage distribution, (ii) how migrants and natives are distributed between the low and higher wage jobs and (iii) the potential employment displacement effects (Dittrich et al. 2011; Dittrich and Knabe 2013; Neumark et al. 2014;). Further note, that the substitution and reservation wage effects induced by the minimum wage may be valid also for labour in informal jobs. This is because if minimum wage increases relative costs of formal low skill labour, employers may have incentive to substitute it with informal low skill labour, which is usually not a direct beneficiary of the minimum wage policy. Similarly, the minimum wage may also increase the reservation wage of labour in informal jobs which may potentially stimulate them to bargain higher wage with employers (particularly for new jobs).

[23] Along the similar line of argument, the recent literature on frictional labour markets suggest that wages incorporate firm-specific pay differences that contribute to a compensation differentiation between minority groups including migrants (Dostie et al. 2020; Gerard et al. 2020). When employers have a wage-setting power, the minority pay gap depends in part on the extent to which higher-paying firms differentially employ mainstream population's workers versus minorities – a between-firm sorting effect – and in part on the relative size of the pay premiums offered by a given firm to different worker groups – a relative wage-setting effect. For example, Dostie et al. (2020) find that firm-specific wage premiums explain a significant share of earnings inequality and contribute to the mean earnings gap between immigrants and natives in Canada.

as a percentage of GDP per capita. A positive cross-country correlation suggests that, in line with theoretical models, the minimum wage policy contributes to reducing a wage inequality between migrants and natives. Further, panel B in Figure 7 shows a negative correlation between the unexplained wage gap and migrants labour market mobility index (a measure of the labour market competition). In contrast, panels C and D in Figure 7 show a positive though relatively low correlation between the unexplained wage gap and the degree of coordination of wage bargaining and the union density rate, respectively. However, from these descriptive results, it is impossible to determine definitely whether wage bargaining coordination and the union density rate cause lower levels of wage inequality, or whether some omitted variables determine both the effectiveness of labour market institutions and the wage gap. For example, the collective wage bargaining effect on realised wages depends among others on the fierceness of competition which is likely to be heterogeneous across countries. The fierceness of competition (and other omitted variables) are not captured in Figure 7 (panels C and D); thus we are unable to interpret these correlations as causal.

Figure 7: Correlations between the unexplained wage gap and the institutional framework



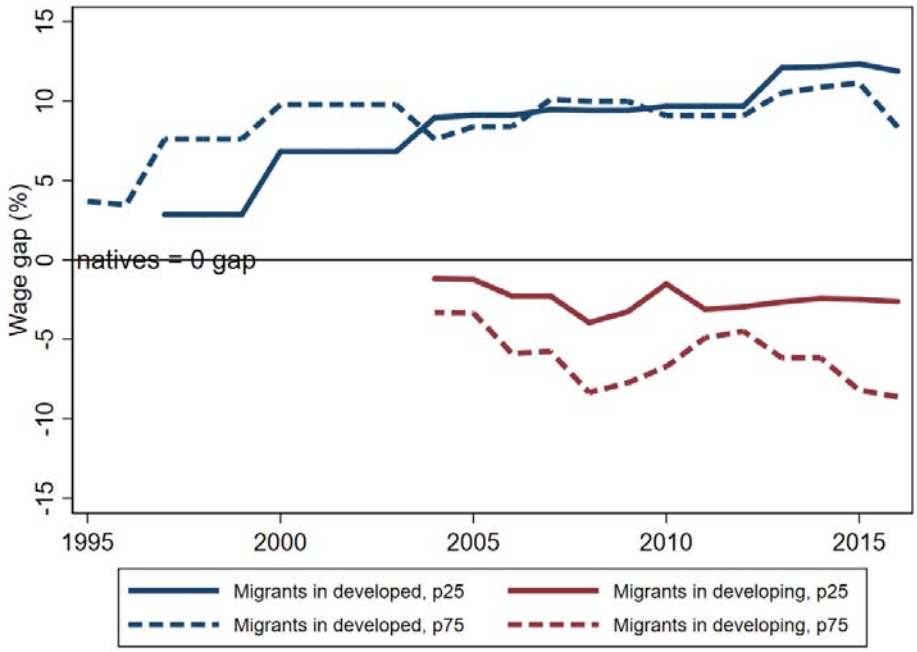
Source: Unexplained wage gaps: estimated based on Luxembourg Income Study data as reported in Table 3; the minimum wage as percentage of GDP per capita is calculated using ILO (2020) data for the minim wage for 2016 and GDP per capita from World Bank (2020) (panel A); the labour market mobility score is from the MIPEX 2015 database and is the average score over the available years between 2010-2014 (Huddleston et al. 2015) (panel B); the coordination of wage-setting index and the government intervention in wage bargaining index are from Visser (2019) and are average scores over the available years between 1995-2016 (panel C); the union density rates are from Visser (2019) and are average scores over the available years between 1995-2016 (panel D).

Both the presented correlative evidence and previous literature findings suggested a nuanced relation between cross-country differences in the institutional framework (measured for example by the minimum wage as a percentage of the GDP) and the cross-country variation in the unexplained wage gap between natives and migrants.

5.5. Further analysis and robustness

In our analysis, we have predominantly focused on computing and presenting the results obtained from the decomposition of wage differences at the mean. As already presented in Section 3, we have further explored the robustness of our results beyond the mean and decomposed the wage gaps at different parts of the wage distribution, namely: p25, p50, and p75. Given the exhaustive set of results that we already present in the paper, here we present a summary of the full set of results obtained from the quantile decompositions.[24] An example of findings from the quantile decomposition is presented in Figure 8.

Figure 8: Native-to-migrant percent unexplained wage gap at different parts of distribution after controlling for productivity differentials in developed economies and transition/developing economies



Notes: a positive wage gap indicates the percentage by which the wages of native-born workers exceed those of the foreign-born.
Source: Luxembourg Income Study data for wage gaps and the UN Population Division, Trends in Total Migrant Stock data for migrant population weights used to calculate the mean wage gap for the two country groups.

Results from the quantile decomposition confirm the baseline results from the mean decomposition: vis-à-vis workers born in developed countries, the workers born in developing economies are disadvantaged both in their home country labour markets and – if migrating – also in developed host countries. However, we can observe two opposite trends between

[24] Full results obtained from the quantile decompositions are available from authors upon request.

developed and developing/transition countries. While in developed countries we observe larger (unexplained) gap at the bottom of the wage distribution (p25), in developing/transition economies we can observe a rather large (negative) gap in the upper part of the wage distribution (p75). Furthermore, we can observe some divergence over the time, especially among developing/transition countries.

6. CONCLUSIONS

In this paper, we have estimated the labour earnings and compared both wages of natives in developed countries vis-à-vis migrants (from other developed and from developing countries), and wages of natives in developing countries vis-à-vis migrants (from other developing and from developed countries). Given that the decomposition of global inequality into between-country and within-country inequality is highly sensitive to data measurement issues, our empirical analysis has been based on a large internationally harmonised microdata – the Luxembourg Income Study – covering 21 countries, 20 years and 1.5 million individuals, which we have leveraged by employing Blinder-Oaxaca counterfactual decomposition techniques to compute the levels of wage differentials and inequality trends of foreign-born and native-born workers.

We have found that vis-à-vis workers born in developed economies, the workers born in transition and developing economies are disadvantaged both in their home country labour markets and – if migrating – also in developed host country labour markets. The estimated Blinder-Oaxaca wage differentials suggest the opposite for workers born in developed countries – their wages are higher not only in developed countries but for migrants also in developing host countries. Our estimates also show that in the developed country sub-sample, the mean immigrant wage disadvantage has remained nearly unchanged over the last two decades both in terms of the inequality trend and variance. The magnitude and growth rate of the mean wage gap for the transition/developing economies sub-sample is similar to developed economies though with the opposite sign – native-born workers in developing countries systematically receive lower wages than foreign-born workers.

Despite that many labour migrants experience a large increase in income when they move from developing home countries to developed host countries, our results point at a large untapped potential monetary gain from migration. In addition to ethical and social considerations, lower demand and lower wages for equally productive foreign workers results also in a waste of valuable human capital resources. Our findings contribute to the growing body of literature that shows that eliminating distortions in the allocation of talent can result in sizeable productivity and welfare gains in developed economies. For example, Hsieh et al. (2019) estimate large gains for the U.S. between 1960 and 2010 – their study focuses on race- and gender-based distortions. Kancs and Lecca (2018) find that although the immigrant integration (e.g. by the providing language and professional training) is costly for the host country budget, in the medium- to long-run, the social, economic and fiscal benefits can significantly outweigh the short-run immigrant integration costs in the EU. Our findings provide an indirect support for the role of immigrant integration policies in leveraging migration potential to realising welfare gains, as labour migration can be an important vehicle for development, when it is fair, well-governed and allows migrant workers to access decent work.

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ONLINE APPENDIX

Appendix A: Additional Tables

A.1 The country sample used in the analysis

Country	Wave IV (~ 1995)	Wave V (~ 2000)	Wave VI (~ 2004)	Wave VII (~ 2007)	Wave VIII (~ 2010)	Wave IX (~ 2013)	Wave X (~ 2016)
Austria (AT)	AT 97 (1,778/189)	AT 00 (1,011/44)	AT 04 (3,154/499)	AT 07 (4,048/759)	AT 10 (4,575/843)	AT 13 (4,158/812)	AT 16 (4,343/866)
Brazil (BR)				BR 06 (71,379/170)	BR 09 (75,380/168)	BR 13 (71,694/204)	
Canada (CA)		CA 00 (5,298/1,396)	CA 04 (5,444/1,368)	CA 07 (5,178/1,413)	CA 10 (4,681/1,380)		
Chile (CL)				CL 06 (43,143/407)	CL 09 (39,495/420)	CL 13 (42,719/1,045)	CL 15 (53,314/1,639)
Czechia (CZ)	CZ 96 (25,925/80)		CZ 04 (3,549/44)	CZ 07 (7,564/73)	CZ 10 (6,887/69)	CZ 13 (6,162/68)	
Estonia (EE)				EE 07 (4,179/903)	EE 10 (3,668/637)	EE 13 (4,282/753)	
Germany (DE)	DE 95 (4,615/1,079)	DE 00 (8,403/1,308)	DE 04 (7,939/1,194)	DE 07 (7,776/1,022)	DE 10 (12,200/1,699)	DE 13 (10,079/1,898)	DE 15 (9,097/2,942)
Greece (GR)	GR 95 (1,998/96)		GR 04 (2,165/275)	GR 07 (1,102/110)	GR 10 (1,292/141)	GR 13 (1,959/156)	
Guatemala (GT)				GT 06 (4,934/43)	GT 11 (7,416/36)	GT 14 (12,799/42)	
Iceland (IS)			IS 04 (3,781/220)	IS 07 (3,410/268)	IS 10 (3,296/211)		
India (IN)			IN 04 (34,328/330)		IN 11 (37,902/433)		
Ireland (IE)	IE 96 (1,567/107)	IE 00 (1,595/86)	IE 04 (3,000/391)	IE 07 (2,915/393)	IE 10 (2,166/523)		
Israel (IL)				IL 07 (2,784/1,903)	IL 10 (3,383/1,915)	IL 14 (5,162/2,466)	IL 16 (5,659/2,390)
Italy (IT)	IT 95 (4,431/99)	IT 00 (4,338/148)	IT 04 (4,033/305)	IT 08 (3,909/475)	IT 10 (3,763/487)	IT 14 (3,375/476)	
Luxembourg (LU)	LU 97 (1,173/850)	LU 00 (975/982)	LU 04 (1,268/1,739)	LU 07 (1,217/2,827)	LU 10 (2,279/3,153)	LU 13 (1,706/2,258)	
Netherlands (NL)			NL 04 (3,504/201)	NL 07 (4,448/223)	NL 10 (4,184/244)	NL 13 (4,132/225)	
Paraguay (PY)		PY 00 (5,882/376)	PY 04 (5,700/289)	PY 07 (3,985/141)	PY 10 (4,283/163)	PY 13 (5,095/156)	PY 16 (8,475/323)
South Africa (ZA)				ZA 08 (3,087/121)	ZA 10 (3,748/43)	ZA 12 (4,319/79)	
Spain (ES)			ES 04 (6,750/508)	ES 07 (10,385/1,083)	ES 10 (7,730/680)		
Switzerland (CH)				CH 07 (4,923/1,665)	CH 10 (4,643/1,721)	CH 13 (4,598/1,471)	
United States (US)	US 97 (48,445/8,158)	US 00 (81,076/13,761)	US 04 (75,339/13,858)	US 07 (73,880/14,962)	US 10 (68,487/14,881)	US 13 (47,018/11,022)	US 16 (64,115/14,835)

Note: Under each country we show the number of native/foreign born population. In our empirical analysis, the total number of natives across countries sums to 1,453,344 individuals, while the total number of immigrants across countries sums to 154,916 individuals.
Source: LIS database.

A.2 Variables definition used in the decomposition analysis

Variable	LIS code	Description
Hourly wage	GROSS1/NET1	Gross/net basic hourly wage rate for the main job. Overtime payments, bonuses and gratuities, family allowances and other social security payments made by employers, as well as ex gratia payments in kind supplementary to normal wage rates, are all excluded from the calculation of the basic gross hourly wage

Employment status	EMP	Indicator of an employment activity in the current period
Industry	INDA1	Industry classification of the main job into 3 categories: • agriculture • industry • services
Immigration status	IMMIGR	All persons who have that country as country of usual residence and (in order of priority): - whom the data provider defined as immigrants - who self-define them-selves as immigrants - who are the citizen/national of another country - who were born in another country
Years of residence	YRSRESID	Cumulative number of years of residence in the country
Wage earners	NEARN	Number of household members with incomes from labour during the income reference year
Education	EDUC	Highest completed level of education: • low: less than secondary education completed (never attended, no completed education or education completed at the ISCED levels 0, 1 or 2) • medium: secondary education completed (completed ISCED levels 3 or 4) • high: tertiary education completed (completed ISCED levels 5 or 6)
Gender	SEX	Classification of persons according to their sex
Age	AGE	Age in years. Note that when original data provide age in intervals, values given are the lowest value of the interval. For example, the intervals 10-14 and 15-19 will be coded as 10 and 15, respectively
Children	NCHILDREN	Number of own children living in household

Source: LIS database.

A.3 Contextual macro-level variables

Variable	Source	Period covered	Country groups covered	Definition
Labour market discrimination				
Discrimination and violence against minorities index	Social Progress Imperative, Social Progress Index	Average 2004-2016 over available years	DC and TDC	The index captures discrimination, powerlessness, ethnic violence, communal violence, sectarian violence, and religious violence, measured on a scale on 0 (low pressures) to 10 (very high pressures)
Tolerance for immigrant score	Social Progress Imperative, Social Progress Index	Average 2004-2016 over available years	DC and TDC	The percentage of respondents answering yes to the question, "Is the city or area where you live a good place or not a good place to live for immigrants from other countries?" It takes values between 0 (=low tolerance) and 100 (=high tolerance).
Job characteristics				
Ratios of foreign-born to native-born in low skill employment	ILOSTAT, International labour migration statistics (ILMS) (https://ilostat.ilo.org/topics/labour-migration/)	Average 2010-2016 over available years	DC	Skill levels considered represent occupation categories based on the International Standard Classification of Occupation (ISCO) as follows. Skill level 1 (low): elementary occupations. Skill levels 3 and 4 (high): legislators, senior officials and managers; professionals; technicians and associate professionals (ILOSTAT 2020)
Ratios of foreign-born to native-born in high skill employment				
Ratio of foreign-born to native-born workers with a temporary contract for low educated workers	OECD (2015a)	Average 2012-2013 over available years	DC	The ratio is calculated as foreign-born to native-born workers with a temporary contract represented as percentages of total employment, (persons aged 15-64 not in education)
Ratio of foreign-born to native-born workers with a temporary contract for highly educated workers				
Share of migrant stock in the total population	United Nations Population Division, International migrant stock 2019	Average 1995-2015	DC and TDC	International migrant stock as a percentage of the total population (both sexes)
Unobserved skills				
Ratio of foreign-born to native-born overqualification	OECD (2015a)	Average 2012-2013 over available years	DC	Ratio of foreign-born to native-born overqualification rates among 15-64 year-olds who are not in education. Overqualification rate is defined as the share of people with tertiary-level qualifications who work in a job that is classified as low- or medium-skilled by the International Standard Classification of Occupations (OECD 2015a)
Share of immigrants born in a high-income country	OECD (2015a)	Average 2010-2011 over available years	DC and one TDC	Percentage immigrant populations aged 15 to 64 years old and born in a high-income country of the total immigrant population
Ratio of foreign-born to native-born in literacy, numeracy and problem solving indicators	OECD, PIAAC	2012	DC and one TDC	The ratio of foreign-born to native-born in literacy, numeracy and problem solving is calculated as a simple average over the individual foreign-born to native-born ratios of indicators for literacy, numeracy and problem solving

Variable	Source	Period covered	Country groups covered	Definition
Ratio of immigrants not speaking the host-country language to those that do	OECD (2015a)	2012	DC	The ratio of the share of immigrants not speaking the host-country language at home or are monolingual native speakers to the share of immigrants who host-country language most often spoken at home
Share of immigrants that are multilingual native speakers	OECD (2015a)	2012	DC	The share of immigrants who are multilingual native speakers
Institutional labour market framework				
Minimum wage (% of GDP per capita)	Minim wage: ILO (2020) data GDP per capita: World Bank (2020) data	2016	DC and TDC	The minimum wage as percentage of GDP per capita
Labour market mobility score	MIPEX 2015 database, Huddleston et al. (2015)	Average 2010-2014 over available years	DC	Labour market mobility score measures to what extent legally-resident foreign citizens have comparable workers' rights and opportunities like nationals to access jobs and improve their skills. The score varies between 0 and 100, where 100 is the top score (Huddleston et al. 2015).
Coordination of wage-setting	Visser (2019)	Average 1995-2016 over available years	DC and TDC	The index captures coordination types ranging between fragmented wage bargaining, confined largely to individual firms or plants (for score 1) and centralized bargaining by the central union and employers' associations, or government imposition of a wage schedule/freeze (for score 5). A higher value indicates a higher degree of wage coordination
Government intervention in wage bargaining index	Visser (2019)	Average 1995-2016 over available years	DC and TDC	The index captures types of coordination ranging between no government influence on wage bargaining (for score 1) and the government imposition of wage settlements to private sector, placing a ceiling on bargaining outcomes or suspending bargaining (for score 5). A higher value indicates a higher degree of wage coordination
Union density rate	Visser (2019)	Average 1995-2016 over available years	DC and TDC	Net union membership as a proportion of wage and salary earners in employment.

Notes: DC: developed countries; TDC: transition and developing countries.
Source: own processing based on existing data sources.

Appendix B: Validity of immigration in the LIS database

B.1 LIS data versus UN data, share of migrants from developed versus developing countries

			1995-2000		2001-2010		2011-2016
	Origin:	Developing	Developed	Developing	Developed	Developing	Developed
	Destination						
LIS data	Developed	63.9	36.1	67.0	33.0	68.6	31.4
UN data	Developed	54.7	45.3	60.2	39.8	62.3	37.7
LIS data	Developing	90.6	9.4	90.2	9.8	87.3	12.7
UN data	Developing	83.6	16.4	85.7	14.3	88.1	11.9

Notes: The Table shows the share of migrants from developed versus developing countries; the total in each period being 100%. For example, in the 1995-2000 period, 63.9% of migrants to developed countries originated from developing countries and 36.1% originated from developed countries (summing up to 100%) – according to the LIS data. According to the UN data, the respective shares for the same period were 54.7% and 45.3% (summing up to 100%).
Source: LIS database; UN Migrant Stock by Origin and Destination (POP/1B/DB/98/5).

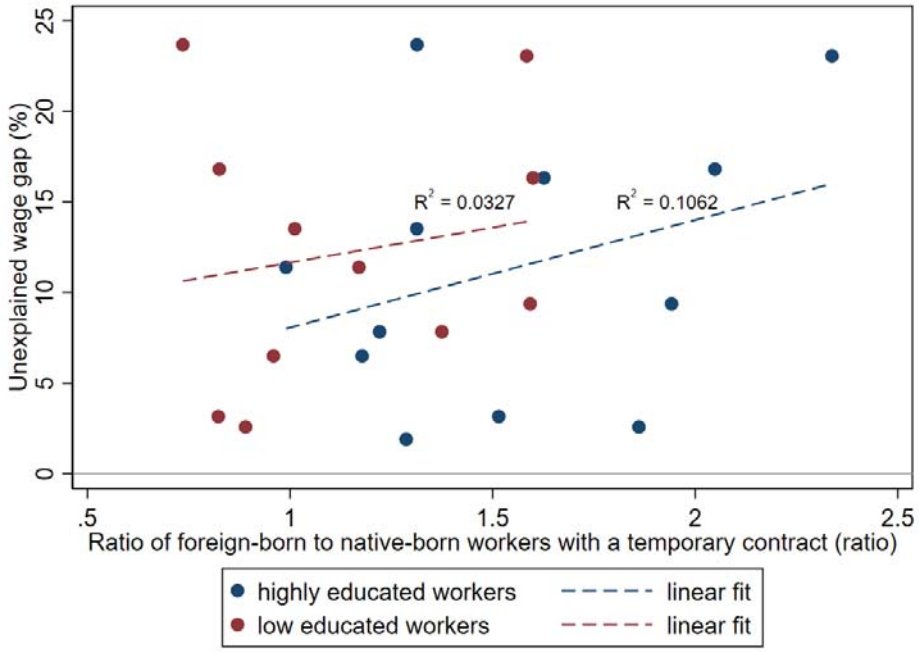
B.2 Structure of immigrant population

		1995-2000		2001-2010		2011-2016
Origin:	Developing	Developed	Developing	Developed	Developing	Developed
Destination:						
Austria	229341	716380	300388	905744	417068	1219048
Canada	2657868	2530479	3968441	2451665	5227415	2467242
Czechia	11464	181727	73014	287503	123058	341522
Estonia	12215	270419	11121	214675	12747	179707
Germany	3119575	5108944	3662844	5944512	4571879	7104403
Greece	304168	680590	349404	906524	339952	887201
Iceland	2596	11719	5409	24883	8466	37273
Ireland	49072	239650	118576	541219	139357	657053
Israel	726630	1095117	715481	1204578	725661	1258376
Italy	1043596	904725	2185471	2685871	2721211	3318315
Luxembourg	5093	127835	4153	152728	20611	249695
Netherlands	1024503	426748	1246524	537795	1410139	729416
Spain	692818	645859	3232900	1960746	3655182	2342524
Switzerland	355350	1169443	484383	1455927	644305	1849907
United States	25620762	6011792	35480363	6240605	43149919	6270095
Destination:						
Brazil	207182	505895	244076	371499	338240	423548
Chile	118262	41613	259901	65973	659434	130425
Guatemala	93822	8332	51378	10440	66316	13071
India	6652348	29437	5659976	21876	5180085	17764
Paraguay	168307	13283	151500	12771	146179	12312
South Africa	773751	236634	1370802	362114	3220148	800328

Notes: UN classification of countries:
https://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf.
Source: United Nations Population Division, Trends in Total Migrant Stock.

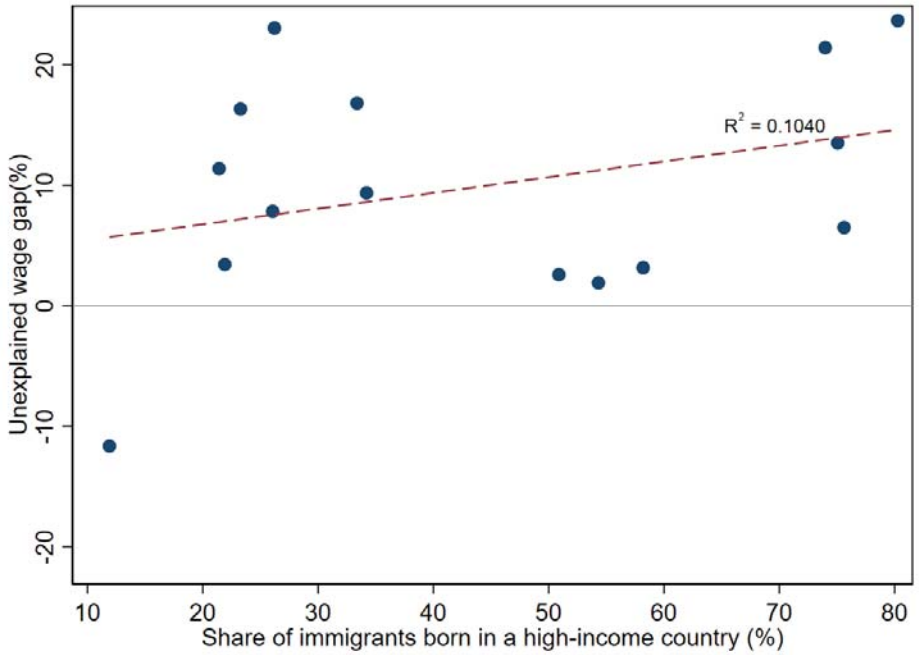
Appendix C: Additional Figures

Figure C.1: Correlation between the unexplained wage gap and the ratio of foreign-born to native-born workers with a temporary contract



Source: Unexplained wage gaps estimated based on Luxembourg Income Study data as reported in Table 3; Ratio of foreign-born to native-born workers with a temporary contract: are from OECD (2015a) and are calculated as average values over the available years between 2012-2013.

Figure C.2: Correlation between the unexplained wage gap and the share of immigrants born in a developed country



Source: Unexplained wage gaps estimated based on Luxembourg Income Study data as reported in Table 3; The share of immigrants born in a high-income country is average for 2010-2011 available from OECD (2015a).