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Abstract

We use microeconomic data on wages and individual characteristics across twenty European economies for the period 2004 to 2015, to detect patterns of misallocation arising in these economies based on individuals' gender, immigrant status, or private versus public sector affiliation. We develop a theoretical model where being relatively isolated, e.g., due to gender, immigrant status, or private sector affiliation, leads to lower wages and talent misallocation. Our empirical results suggest that being a female or immigrant, and working in the private sector, exert a negative impact on one's wages beyond that explained by their economic characteristics, suggestive of persistent talent misallocation in Europe during the period under study. Notably, countries such as Cyprus, Greece, Italy and Spain are systematically found at the top of the overall talent misallocation index we construct year-after-year for the period under study. Our work provides new cross-country micro-econometric evidence about the importance of various forms of talent misallocation for aggregate economic outcomes.

Keywords: Economic Growth, wage gap, inefficiency.

JEL Classification: E0, J31, O4, O52

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1 Introduction

The allocation of talent across economic activities is an important determinant of economic growth as argued early on by Baumol (1990) and Murphy et al. (1991). When talent is misallocated this can lead to inefficiencies that suppress economic growth and harm the welfare of societies. We utilize microeconomic data on wages and individual characteristics across European economies for the period 2004-2015 to investigate the overall misallocation effects implied by the combined gender and public-private wage gaps, as well as from the pay-gap between foreign and native born workers. In our theoretical model, these wage gaps and misallocation are both generated by the degree of connectedness that different workers have in the labor market: the lower the degree of connectedness, the higher the wage differential and the higher the misallocation.

We assess the extent to which wages differ across public versus private, female versus male, and foreign as compared to native born workers for individuals that otherwise share similar characteristics. In the absence of data on differences in connectedness or direct numbers for talent misallocation, these wage differentials serve as an implicit index for talent misallocation. As illustrated in our theoretical model such unwarranted differences in earnings imply misallocation in the economy, with potentially important adverse effects for aggregate economic outcomes.

To help motivate our empirical analysis, we construct a specific theoretical model that links network connectivity with wage differences and talent misallocation. This theoretical model generates wage differences for individuals with similar characteristics based on their degree of network connectivity, which in turn might depend on things like their sex, race or country of origin, and political or other affiliation. More specifically, we consider an economic environment with two types of jobs one of which is more productive than the other, and a labor market where workers are equally talented but differ with respect to their network connectivity. They can be either "connected" or "isolated". These workers perform undirected search and those with network connections can find a job more easily than "isolated" ones as the latter face a lower job finding rate. In such an environment, "connected" types will be allocated only to high-productivity positions, while the "isolated" would also work in low-productivity jobs, despite the fact that all workers have the same ability. This means that there is talent misallocation in this economy. Moreover, isolated workers receive a lower wage than their connected counterparts because the latter are in a better bargaining position due to a higher outside option. Here, "isolation" relates broadly to foreign workers who lack the "connectedness" of domestic ones, and to women who do not enjoy the privileges of "boy's clubs". More broadly, "isolation" might also characterize workers in the private sector who lack the political or social "connectedness" characterizing those that manage to land a job in the public sector.

The study most related to ours is Hsieh et al. (2013) who investigate the aggregate productivity gains in the US between 1960 and 2010, attributing these to decreases in labor market discrimination towards women and African-Americans. Using a model of occupational choice, they find that one quarter of aggregate growth in GDP per person for the US during the last 50 years can be explained by declines in talent misallocation.

Our work is also related to the literature examining the aggregate costs of gender inequality. Cavalcanti and Tavares (2016) develop a growth model with endogenous fertility and barriers to female labor market participation in the form of wage discrimination. They calibrate the model for the US economy and find that a 50 percent increase in the gender wage gap leads to a 35 percent decrease in *per capita* income.[1] They also find that a very large fraction of *per capita* output in several countries relative to the US, can be explained by gender discrimination differences. Cuberes and Teignier (2016) present an occupational choice model that quantifies the effects of gender wage gaps on aggregate productivity and income *per capita*. In their model, women face several restrictions on their occupational decision and on their participation in the labor market, leading to an inefficient allocation of talent across occupations that reduces entrepreneurs' average talent and as a result aggregate productivity and *per capita* income in the economy as

[1] Here, gender discrimination discourages female labor market participation and increases fertility both of which lead to a decline in *per capita* output.

a whole. Calibrating the model for 33 OECD countries for 2010, they find that gender gaps cause an average loss of 15 percent in income *per capita*.

Moreover, our paper is related to the literature studying wage differentials between immigrants and native-born workers. Chassamboulli and Palivos (2014) develop a search and matching model with skill heterogeneity to analyze the impact of immigration on the labor market outcomes in the host country. They allow for differential search costs between natives and immigrants, which is a key factor in explaining the equilibrium wage gap between otherwise identical native and immigrant workers. Within the same framework, Liu et al. (2017) consider imperfect transferability of human capital across borders, and cross-skill matching in the labor market where the high-skilled workers search for jobs in both high- and low-skill markets. These assumptions put skilled immigrants at a disadvantage on the bargaining table relative to skilled natives, so that they become willing to accept low-skill jobs at a much greater rate compared to their native counterparts.

Furthermore, our work is related to the literature that investigates the macroeconomic costs of an overpaid public sector. For example, Santos and Cavalcanti (2015) assess the implications of earning differentials between the public and private sectors by developing a model with endogenous occupational choice among the public and private sectors, where an inefficiency arises due to a public sector premium. They calibrate the model to Brazil and show that the presence of a public-private earnings premium can generate important allocation effects for an economy. They show that a reform reducing the public-private wage premium by 12 percent could increase aggregate output by up to 16 percent in the long-run.[2] Jaimovich and Rud (2014) also study the effect of an oversized inefficient public sector on economic performance through an occupational choice model and show that when the public sector attracts bureaucrats with low degree of public service motivation they extract rents by hiring an excessive number of unskilled

[2]The intuition behind these results is that earning differences between public and private workers affect their occupational choice and generate misallocation. The public sector attracts high productive agents looking for higher-paying jobs crowding out potentially more productive private sector employment which leads to lower productivity in the private sector and the economy as a whole.

workers. This leads to an equilibrium with relatively high unskilled wages which reduces profits and makes the private sector relatively unattractive for potential entrepreneurs.[3]

Finally, our paper relates to the literature investigating the causes of economic development and productivity differences across countries. The existing literature, as surveyed, e.g., by Caselli (2005) and Jones (2016), suggests that Total Factor Productivity (TFP) plays an important role in explaining income differences across countries. One of the reasons that TFP might vary across countries is because countries do not allocate inputs efficiently. In this case, factor reallocation from less to more productive uses could increase output. Hsieh and Klenow (2009) show, for example, that reallocation of factors across plants could substantially increase efficiency in the likes of China and India.

Based on microeconomic data on wages and individual characteristics across Europe over the decade ending in 2015, we find that females, migrants, and private sector employees receive lower hourly wages than their other characteristics would imply. Furthermore, aggregating these micro-based results at the country level, we find that Cyprus, Greece, Italy and Spain, all of which were at the heart of the European Crisis, have the highest misallocation indices for the period under study.[4] Our paper provides new cross-country micro-econometric evidence that supports the findings of the surging literature described in the previous paragraphs regarding the importance of various forms of talent misallocation for aggregate economic outcomes.

The rest of the paper is organized as follows. Section 2 presents a search and matching model to examine the effects of network connectivity on labor market outcomes. Section 3 describes the data and variables used in our study, and presents our empirical approach. Section 4 presents estimation results, while section 5 briefly concludes.

[3]Indeed, empirical evidence from micro-studies reports negative pay differentials for the private sector unexplained by observed individual characteristics such as education and experience.

[4]Luxembourg, an economy with a huge financial sector, is also typically one of the top countries according to our misallocation index. However, interestingly, Portugal is not ranked among the countries with the highest estimated talent misallocation indices, which is broadly in line with Martin and Philippon (2017) which argue that Portugal's problems were mostly due to exogenous factors like the ECB not acting early enough.

2 The Model

We develop a search and matching model of the labor market (e.g., Mortensen and Pissarides, 1994) in which workers have a different degree of social network connectedness. Time is continuous.

2.1 Main Assumptions

The economy is populated by a continuum of workers and a continuum of firms. The measure of workers is normalized to one, whereas the measure of firms is determined endogenously. All agents are risk neutral and discount the future at a constant interest rate $r > 0$.

There are two types of workers. A fraction $\mu \in (0, 1)$ of them is isolated whereas the remaining $1 - \mu$ is connected (more on this below). A worker's type is indexed by $j \in \{C, I\}$. Nevertheless, all workers are equally talented/skilled. We assume that each firm has at most one position and use the terms firms, jobs, and positions interchangeably. There are also two types of jobs: low-productivity (L) and high-productivity (H) jobs. They are indexed by $i \in \{L, H\}$. A firm decides the type of job/position that it will create. We assume that creating either type of vacancy is costless and entry is free. There is, however, a flow hiring cost c, which is paid until the vacancy is filled. In principle, each vacancy can be filled by a worker of either type.[5] A match between a low- (high-) productivity job and a worker results in output y_L (y_H), where $y_H > y_L > 0$. Thus, the productivity of a job does not depend on the type of worker that occupies it.

Since each firm can create at most one position and the cost of it is zero, profit maximization and free entry amount to an expected-zero-profit condition for firm entry and exit. Such a condition will determine endogenously the number of firms.

During unemployment spells, all workers receive a flow of income b, which can be

[5] However, as shown next, connected workers will not occupy low-productivity jobs in equilibrium.

regarded as the opportunity cost of employment, i.e., it includes any unemployment benefits and the value of leisure (home production). We assume that $y_H > y_L > b > 0$.

2.2 Matching

Unemployed workers and vacant positions are brought together via a stochastic matching technology. The matching process is undirected. Connected workers, that is, workers with strong social network connections, can find jobs more easily that the isolated ones. The latter include, for example, women, who do not enjoy the traditional privileges of "boy's clubs". These informal social networks could generate some kind of barriers for women in the workplace. Examples of boy's clubs are golf courses, saunas, and sports events, where women are significantly less likely to be invited. Moreover, "isolation" might also occur to immigrants who lack the "connectedness" of native workers. For example, when seeking for a job in the host country, immigrants often face formidable information obstacles that emanate from limited language skills, cultural differences, lack of a supportive family and friends framework, low income, and so on. More broadly, "isolation" might also apply to workers in the private sector who lack the "connectedness" characterizing workers in the public sector. It is well known that in certain countries, whenever there is a change in government, there is a substantial turnover of jobs. Such turnover occurs even in Western democracies (e.g., Greece and Spain) at the middle and senior management levels. This is so because a certain portion of the jobs in the public sector are reserved for workers that have personal or social connection to the political party that is in government.[6] Moreover, often civil and public servants or employees in big corporations, banks, etc., use their personal connections and influence to get their friends or family members hired by their own employer.

To capture the fact that isolated workers have a handicap in job search, we assume that they have a lower number of efficiency units (or lower search intensity) than the

[6] Chassamboulli and Gomes (2018) examine the effects of non-meritocratic hiring in the public sector using a search and matching framework.

connected workers. The total flow of random contacts between unemployed workers and vacancies is given by a constant-returns-to scale matching function, which has positive first-order and negative second-order partial derivatives and satisfies standard Inada conditions:

$$M = M(\upsilon_L + \upsilon_H, u_C + \gamma u_I)$$

where υ_i, is the mass of vacant positions of type $i = L, H$, u_j is the mass of unemployed workers of type $j = C, I$ and $\gamma \in (0, 1)$ is the relative search intensity of isolated workers. We define the effective labor market tightness as $\theta \equiv (\upsilon_L + \upsilon_H)/(u_C + \gamma u_I)$. The rate at which a firm meets a worker is $q(\theta) = M/(\upsilon_L+\upsilon_H)$, where $q'(\theta) < 0$. On the other hand, the rate at which a connected worker finds a job is $m(\theta) = M/(u_C + \gamma u_I)$, whereas the corresponding rate for isolated workers is $\gamma m(\theta) < m(\theta)$.[7]

We also assume that all matches dissolve at an exogenous rate $\delta > 0$. Whenever a job is destroyed the worker becomes unemployed and starts looking for a new job, while the firm becomes vacant and can either withdraw from the market or open a new position.

2.3 Asset Values

We let F and V denote asset values associated with a filled and an unfilled vacancy and E and U asset values associated with an employed and an unemployed worker, respectively. For example, U_j denotes the expected present discounted income of an unemployed worker who is of type j and E_{ij} denotes the expected present discounted income of an employed worker who is of type j and is matched with a job of type i. Then in steady state:

$$rU_C = b + m(\theta)\{\xi max[(E_{LC} - U_C), 0] + (1 - \xi)(E_{HC} - U_C)\}, \tag{1}$$

[7] We note that our emphasis is on the lower contact rate (job finding rate) that the isolated workers experience relative to that of connected workers and not on a lower job matching rate. The latter may be the result of discrimination in which case two workers, a connected and an isolated, can have the same job-finding rate but different probability of getting hired (matching rate). Indeed, discrimination can be captured by assuming a matching rate $m(\theta)$ for one type of workers and $\gamma m(\theta)$, $\gamma < 1$, for the other, where in this case the market tightness θ would be $\theta \equiv (\upsilon_L + \upsilon_H)/(u_C + u_I)$.

$$rU_I = b + \gamma m(\theta)\{\xi(E_{LI} - U_I) + (1-\xi)(E_{HI} - U_I)\}, \tag{2}$$

$$rE_{LC} = w_{LC} - \delta(E_{LC} - U_C), \tag{3}$$

$$rE_{LI} = w_{LI} - \delta(E_{LI} - U_I), \tag{4}$$

$$rE_{HC} = w_{HC} - \delta(E_{HC} - U_C), \tag{5}$$

$$rE_{HI} = w_{HI} - \delta(E_{HI} - U_I), \tag{6}$$

where $\xi = \upsilon_L/(\upsilon_L + \upsilon_H)$ is the fraction of vacant positions that are low-productivity ones and w_{ij} is the wage earned by a worker of type j who is matched with a vacancy of type i. The term $max[(E_{LC} - U_C), 0]$ appears to capture the case where connected workers do not consider it worthwhile to be employed on low-productivity jobs. Similarly, the asset values associated with the firms are:

$$rV_L = -c + q(\theta)\{\phi(F_{LI} - V_L) + (1-\phi)max[(F_{LC} - V_L), 0]\}, \tag{7}$$

$$rV_H = -c + q(\theta)\{\phi(F_{HI} - V_H) + (1-\phi)(F_{HC} - V_H)\}, \tag{8}$$

$$rF_{LC} = y_L - w_{LC} - \delta(F_{LC} - V_L), \tag{9}$$

$$rF_{LI} = y_L - w_{LI} - \delta(F_{LI} - V_L), \tag{10}$$

$$rF_{HC} = y_H - w_{HC} - \delta(F_{HC} - V_H), \tag{11}$$

$$rF_{HI} = y_H - w_{HI} - \delta(F_{HI} - V_H), \tag{12}$$

where V_i denotes the expected income accrued to a vacant position of type i, F_{ij} is the expected income accrued to a filled position of type i that is matched with a worker of type j and $\phi = u_I/(\upsilon_I + \upsilon_C)$ is the fraction of unemployed workers that are isolated.

As mentioned above, there is free entry at zero cost and hence, in equilibrium, the expected payoff of posting a vacancy is zero:

$$V_i = 0, \;\; i = L, H. \tag{13}$$

2.4 Wage Determination

The wage rate is determined according to a generalized Nash bargaining rule, where the worker's bargaining power is $\beta \in (0,1)$, that is, the wage rate must be such that

$$(1-\beta)(E_{ij} - U_j) = \beta(F_{ij} - V_i) \tag{14}$$

In other words, the worker receives a share β and the firm $1-\beta$ of the generated surplus S_{ij} :

$$S_{ij} = F_{ij} + E_{ij} - V_i - U_j, \;\; i = L, H, \;\; j = C, I. \tag{15}$$

That is,

$$F_{ij} - V_i = (1-\beta)S_{ij}, \tag{16}$$

$$E_{ij} - U_j = \beta S_{ij}. \tag{17}$$

It follows that a match between an unemployed worker of type j and a firm of type i will be consummated if and only if $S_{ij} > 0$. Using one of (9), (10), (11), and (12), to substitute away F_{ij}, one of (3), (4), (5), and (6), to substitute away E_{ij}, and the free-entry condition $V_i = 0$, we have that

$$(r+\delta)S_{ij} = y_i - rU_j. \tag{18}$$

It follows then that a match will be formed if and only if

$$y_i > rU_j \tag{19}$$

Moreover, assuming that (19) holds, equations (3), (4), (5), (6), together with (17) and (18), yield

$$w_{ij} = \beta y_i + (1-\beta) rU_j \tag{20}$$

As it is common in this case, the wage is a weighted average of the output of the match and the worker's flow value of unemployment. Also, equation (1) can be written as

$$rU_C = b + \beta m(\theta)\{\xi max(S_{LC}, 0) + (1-\xi)S_{HC}\}.$$

Hence using (18), we have that

$$rU_C = \frac{(r+\delta)b + \beta m(\theta)[\xi y_L + (1-\xi)y_H]}{r+\delta+\beta m(\theta)} \qquad if \;\; S_{LC} > 0 \tag{21}$$

and

$$rU_C = \frac{(r+\delta)b + \beta m(\theta)(1-\xi)y_H}{r+\delta+\beta m(\theta)(1-\xi)} \qquad if \;\; S_{LC} \leq 0. \tag{22}$$

Similarly,

$$rU_I = \frac{(r+\delta)b + \beta\gamma m(\theta)[\xi y_L + (1-\xi)y_H]}{r+\delta+\beta\gamma m(\theta)} \tag{23}$$

2.5 Equilibrium

A steady-state equilibrium in this economy consists of values of $\{u, \theta, \xi, \phi, w_{ij}\}$ such that (a) all matches produce a positive surplus; b) the free-entry conditions (13) and the steady-state conditions $\dot{u}_I = d(\phi u)/dt$, and $\dot{u}_C = d[(1-\phi)u]/dt = 0$ hold, where it may be recalled that $u = u_C + u_I$; and Nash bargaining conditions (14) for a worker of type j and firm of type i hold.

First consider the following proposition:

Proposition 1. No matches between connected workers and low-productivity jobs will be formed in equilibrium.

Proof. All proofs are presented in the Appendix.

The intuition for this result is that, given the lower output of a low-productivity position ($y_L < y_H$) and the better outside option of a connected workers ($rU_C > rU_I$), the surplus generated from a match between a low-productivity job and a connected worker is negative. Thus, there will be no match between connected workers and low-productivity jobs.[8]

Next, consider

Proposition 2. A steady-state equilibrium in which there are both high- and low-productivity jobs exists.

According to Proposition 2, there are isolated workers who work at low-productivity jobs and produce a low output, despite the fact that they are equally talented with the connected and the rest of the isolated workers; this means that there is talent misallocation in this economy. Propositions 1 and 2 imply that at most three wages are paid in equilibrium. Moreover,

Proposition 3. Connected workers receive a higher wage than the isolated. Specifically, $w_{HC} > w_{HI} > w_{LI}$.

Connected workers who work at high-productivity jobs receive a higher wage than their isolated counterparts because they have a higher outside option ($rU_C > rU_I$) and hence they are in a better bargaining position. This is so, despite the fact that both types of workers are equally productive. Moreover, there are isolated workers who work at low-productivity jobs and hence receive lower wages than the isolated workers who work at high-productivity jobs, despite the fact again that the two groups are equally talented.

Consider,

[8] There **may be** an equilibrium in which some of the other surpluses are non-positive, e.g., $S_L I \leq 0$; in that case, there will be no matches between isolated workers and low-productivity jobs as well. We dismiss all other cases as uninteresting, albeit they can be analyzed following similar steps.

Proposition 4. If all workers have the same degree of social network connectedness, i.e., if $\gamma = 1$, then there will not be any low-productivity jobs in equilibrium and thus no talent misallocation.

Proposition 4 shows that equal access to the job market for all equally productive workers is a sufficient condition for the lack of talent misallocation. The intuition behind this result is, of course, that if all workers have the same degree of social network connectedness, then all workers have the same outside option and will bargain for the same wage. Thus, low-productivity jobs cannot compete and attract any worker.

3 Empirically investigating talent misallocation

3.1 Data

We use microeconomic data to detect patterns of misallocation in European countries based on individuals' gender, immigrant status or private versus public sector affiliation. In particular, we use cross-sectional data at the individual level from the European Union Statistics on Income and Living Conditions (EU SILC) collected by Eurostat from 2004 to 2015. The number of countries varies from wave to wave. Due to lack of detailed information regarding migration status, countries such as Estonia, Germany, Latvia, Malta and Slovenia are excluded. Our final sample consists of twenty-seven European countries.

We consider the degree to which wages are based on educational and other characteristics and whether gender, migration status, and private sector affiliation have explanatory power for wages in addition to those other observed characteristics. We estimate the parameters using a Heckman model to deal with sample selection. In the second stage, we follow the common approach of running Mincer-type wage regressions using the natural logarithm of average hourly earnings of each employee as the dependent variable of the analysis. We define the hourly wage as Annual Income divided by Number of months worked, times weekly hours of work, times 4.2. Annual income is given by gross employee cash or near cash income which refers to the monetary component of the compensation of employees in cash payable by an employer to an employee.

Our baseline wage regressions for individuals across Europe consider characteristics such as education, age[9], occupation, part-time work, permanent job status, along with female and birthplace dummies. Our specifications will also include a binary variable denoting that the individual works in the private sector. The distinction between private and public sector employment is based on the Statistical Classification of Economic Activities (NACE) Revisions 1.1 and 2. The public sector can be defined using either the restricted or the broad definition. The first defines a public sector worker as one employed in the sector "Public administration and defence, compulsory social security" while the broad definition takes also into account the sectors "Education" and "Health and social work". However, the broad definition tends to overestimate the share of public sector workers in total employees since some of the employees included in NACE sectors "Education" and "Health and social work" are involved in private activities. We thus prefer to define the public sector using the restricted definition.

Our main empirical objective is to compare wages in the private versus public sector, for women versus men, and for immigrants versus non-immigrants, and to detect whether these pay gaps constitute evidence of talent misallocation. With this in mind, we exclude from the sample students and individuals below 25 and above 64, those retired and disabled, and soldiers. We also exclude the self-employed as well as family workers because in a number of countries incomes are not thought to be completely declared. On the other hand, we keep individuals that worked for part of the year. Noting that Annual Income includes earnings from the main job and from any secondary jobs while the information regarding the number of months worked refers only to the main job, we keep only individuals working in the main job in our sample in order to be able to calculate hourly wages. The final sample includes the unemployed, the inactive, and individuals working in full-time and part-time occupations, which can be potentially

[9] Age is used as a proxy for experience as this is not available for a number countries including Denmark and Norway.

important for females in certain countries.

3.2 Empirical Specification

Our objective is to estimate wage differentials by considering a Mincer-type wage regression of the logarithm of the hourly wage on a wide set of individual characteristics as follows:

$$w_{ij} = \beta_0 + \beta_1 Private_{ij} + \beta_2 Female_{ij} + \beta_3 MigrantEU_{ij} + \beta_4 Migrant_{ij} + \beta \mathbf{X}_{1ij} + \alpha_j + \epsilon_{ij} \tag{24}$$

where w_{ij} is the logarithm of the hourly wage of the individual i in country j, $Private_{ij}$ is a dummy variable indicating whether the individual works in the private sector, $Female_{ij}$ is a dummy variable indicating the gender, $MigrantEU_{ij}$ is a dummy variable indicating whether the person is an immigrant from an EU country, $Migrant_{ij}$ is a dummy variable indicating whether the person is an immigrant from a non-EU country, and X_{1ij} is a vector of covariates that includes three controls for education (L=less than secondary, S=secondary and H=higher education), four controls for occupation[10], four controls for age, and binary variables denoting part-time work and permanent job status. Finally, β_0 and α_j are the constant and country-fixed effects respectively, and ϵ_{ij} is the error term.

A problem that arises in this case, is that we observe wages only for individuals that are in the labor market, but not for those outside the labor force. We therefore have a selected (non-random) sample, which can be viewed as a specific case of endogeneity bias. In order to correct for this selectivity bias, we use the Heckman method which consists of two steps. First, we use all observations and estimate a probit equation:

$$T_{ij} = 1(\delta \mathbf{X}_{2ij} + \alpha_j + e_{ij} > 0) \tag{25}$$

[10] The four occupation dummies are: a=craft and related trade workers, plant and machine operators and assemblers, and elementary occupations; b=clerks, and services and shop and market sales workers; c=professionals, technicians and associate professionals, skilled agricultural and fishery workers, and armed forces; d=legislators, senior officials and managers

T_{ij} is a binary dependent variable with zero indicating being out of the labor force and unity indicates being in the labor force either via paid employment or by being unemployed. X_{2ij} is a vector of covariates that includes variables in the vector X_{1ij} from equation (24) along with dummy variables indicating the employment sector, gender, and immigration status. Moreover, as it is highly recommended to impose at least one exclusion restriction[11] we include marital status (*Married*), number of dependent children and adults (*dependn*), family/children related allowances (*Benefits*), exogenous income (*exg-inc*) [12] and bad health status (*Health*), in addition to the above common regressors that appear in the second stage. Based on parameters estimates $\hat{\delta}$, we compute the inverse Mills ratio (λ) for each observation. Next, using the selected sample, we estimate the Mincer-type wage regression on a set of individual characteristics, fixed effects, and the Mills ratio, as follows:

$$w_{ij} = \beta_0 + \beta_1 Private_{ij} + \beta_2 Female_{ij} + \beta_3 MigrantEU_{ij} + \beta_4 Migrant_{ij} + \beta \mathbf{X}_{1ij} \\ + \gamma_1 \lambda(\hat{\delta}\mathbf{X}_{2ij}) + \alpha_j + \upsilon_{ij}$$

We estimate the private-public, gender, and immigrant-native wage gaps, as the coefficients of the private sector, female, and foreign-born dummies respectively from the above-specified wage regression of the logarithm of the hourly wage on individual characteristics. That is, parameter β_1 captures the private-public earning gap, β_2 captures the female wage gap, β_3 the earning gaps between EU migrants and natives, and β_4 is the earning gap between non-EU migrants and natives.

More detailed specifications include interactions such as migrants with education to capture potentially different wage impact for migrants based on their educational status. The other interactions examined are employment status with education, female with education, and female with part-time job status. In the theoretical part workers

[11] In other words, the selection equation needs to be specified in such a way so that there is at least one variable that determines selection but which has no direct effect on wages. The reason is that with exactly the same variables in both equations the second stage of Heckit would suffer from collinearity.

[12] Exogenous income refers to income from rental of a property or land, interest and dividends and unincorporated profits, and regular payments received from other households or persons.

are divided as "connected" versus "isolated" without considering the fact that there might be some overlap between them. For example, private sector employees might be females or immigrants. At this point, we allow for this possibility empirically by taking interactions of private sector status with female, migrant with female, and migrant with private sector status.

We first estimate the parameters for the European countries as a whole (pool) for each year, and subsequently we allow for the effects of our parameters of interest to differ across countries. That is, in our preferred specification, we allow the coefficients of $Private_{ij}$, $Female_{ij}$, $MigrantEU_{ij}$ and $Migrant_{ij}$ to differ for each country. This makes it possible for us to create an index for each country that indicates the overall misallocation effects arising from the private-public and female wage gaps as well as from the pay gap between foreign and native born workers.

4 Results

Tables 1 and 2 report the results of the wage regressions for the year 2005 and 2015 respectively.[13] Our results suggest that for these group of countries, being a female or immigrant, and working in the private sector exert a negative impact on one's wages beyond that explained by their economic characteristics. This is suggestive of persistent talent misallocation in Europe during the period under study. These results are robust to including a number of variables in the wage regression such as education, occupation, age, part-time job, and permanent job status. Moreover, these results hold for different years we consider.

Noting that sample selection bias arises when the residual in wage equation (24) is correlated with the residual in the probit equation (25), we use the Heckit procedure to estimate the parameter for the explanatory variable $\lambda(.)$, γ_1, which measures the

[13] However, we note that we estimate the same equation across individuals and countries for each year separately, and the estimates thus obtained for each year are qualitatively similar to those in Tables 1 and 2. In Table 1, we report results for 2005 rather than for 2004 which was the first year this survey was conducted for a smaller less representative sample of nine countries, as compared to sixteen a year later.

covariance between the two residuals. Under the null hypothesis that there is no selectivity bias, γ_1=0. As we show in Tables 1 and 2, the parameter for $\lambda(.)$ is significantly different than zero, suggesting the importance of correcting for sample selection.

In relation to the private-public wage gap, we find that in 2005 private sector employees were paid 8.6 to 12.1 percent less than public sector employees, depending on the specification in Table 1. A decade later, the average private-public wage gap in these European countries was still present and estimated to be between 8 and 10.4 percent in Table 2. As for the gender gap, the negative effect of being female on hourly wages ranged around 18 percent in 2005 and remained at high levels in 2015. Looking at the impact of the country of origin on the wage gap relative to locals, we obtain differential impact on hourly wages for EU versus non-EU migrants. It turns out that wage gaps associated with the place of birth are always larger for migrants from non-European countries which were estimated to be as high as 18 percent in both 2005 and 2015. As compared to this, the total effect of being an EU migrant on wages was as high as 6.6 percent in 2005 and 12 percent in 2015.[14]

Having looked at the total effect of our variables of interest, we now take a closer look at their interactions with a number of other variables. These interaction terms suggest different wage impact of certain variables for the private as compared to the public sector, for females as compared to males, and migrants as compared to non-migrants. The interaction of private sector status with education indicates the important role that education plays in reducing wage gaps between public and private sector employees. Moreover, high education improves wages narrowing the wage gap for females. Highly educated females face reduced gender wage gaps compared to females with lower level of education. In the same spirit, the wage gaps between non-EU migrants and natives are lower for individuals with higher levels of education. This also holds for EU migrants. Moreover, gender wage gaps are larger in the private sector as compared to the public

[14] By 2015 the EU migrant definition includes migrants from countries such us Bulgaria, Croatia and Romania which are economically and otherwise more dissimilar than earlier EU entrants among them. This is consistent with more distant economic backgrounds for EU-origin migrants relative to the average European host country in 2015 as compared to 2005, and is likely behind the higher coefficient we estimate for the effect of being an EU migrant on wages in 2015.

sector, and those born in non-EU countries face a higher wage gap in the private sector and if they are female. Furthermore, the gender wage gap is somewhat lower for females born in another EU country, and considerably lower for females working part-time.

Finally, we note that the average impact of the included covariates on hourly wages in these European countries typically has the expected sign. We find that workers with low education receive lower wages as compared to workers with secondary education, and that those with high education receive higher wages as compared to those with only secondary education. In addition, age, used as a proxy for experience, has a positive impact on hourly wages for all age groups compared to younger working individuals of ages 25 to 34. Moreover, wages are higher in high-skilled occupations as compared to low-skilled ones. Furthermore, hourly wages are lower for those that do part-time work, and higher for workers with a permanent contract.

Table 3 reports the results for the years 2005 and 2015 from estimating the probit equation described in section 3.2, where unity indicates paid employment or unemployment and zero out of labor force. The results show that being a female and having being born in a foreign country, both reduce the likelihood of being in the labor force. Similarly, currently working in the private sector reduces the likelihood that this worker was in the labor force during the previous year. The same goes for low education, being in the age group between 55 and 64, bad health, the number of dependent children and adults in the household, being a recipient of social benefits, and having exogenous income. On the other hand, being in the age groups between 35 and 54, part-time work, having a permanent contract, and being married, are associated with higher probability of being in the labor force. These results are qualitatively robust over the years.

Country-specific estimates

We also estimate regression specifications for each year from 2004 to 2015 that allow for the estimated coefficients of the private sector, gender, and migrant status, to be country-specific. These country-specific estimates allow us to construct the results presented in Table 4 summarizing our findings regarding the overall wage gap or 'misallocation index' for each country averaged over the period from 2004 to 2015. To construct this gap, we obtain country-specific coefficients and the resulting total effect of private sector status, female status and migrant status for each year, and then average these total effects over the period from 2004 to 2015. For each country, we also present an index indicating the separate misallocation effect arising from the private-public, female-male, and migrant-native wage gaps.[15] The talent misallocation indices are highest for Cyprus, Luxembourg, Spain, Italy and Greece as can be seen in Figure 1, while Belgium, France, Croatia, United Kingdom and the Netherlands have the lowest indices in Europe.

A look at the components of the index in the first four columns of Table 4 reveals that the gender wage gap is the main factor contributing to the overall misallocation index. The average gender wage gap across these European economies over the period 2004-2015, is 17.8 percent. This is closely followed by the wage gap between non-EU migrants and natives which equals 15.3 percent, while the private-public wage gap averages 9.1 percent, and the average wage gap between EU migrants and natives 8.4 percent. There is, however, a high degree of heterogeneity across countries regarding the main factor that affects the total index.

The private-public conditional wage gap component of the overall index is greater on average (over the period 2004 to 2015) in the case of Cyprus, Portugal, Lithuania, Spain and Ireland as we can see in Table 4 and in Figure 2. On the other hand, Sweden, Norway, Belgium, Finland and France have the lowest private-public wage gaps. Regarding the gender wage gap conditioning on a large number of individual characteristics these were larger on average in Lithuania, the Czech Republic, Cyprus,

[15]We assume that each factor has the same weight when we construct the overall index, choosing to be agnostic about which form of misallocation is potentially more important for an economy's long term prospects. An alternative would be to use the share of private sector employees, females, and migrants in each country as a weight for the importance of the misallocation effect attributed to each of these factors. However, weighting the estimated coefficients with labor force share weights would be misleading as a small share for one of the factors we consider does not imply that this is not an important source of misallocation for a specific country. On the contrary, this could be due to the country having severe misallocation problems associated with that factor, e.g. sexism in the likes of Saudi Arabia or racist politics in the likes of Hungary could lead to women or potential migrants never entering the labor force in those countries to begin with.

Norway and Iceland as shown in Figure 3. The lowest gender wage gaps are present in Luxembourg, Belgium, Italy, Portugal and Switzerland.

Moreover, the negative wage impact associated with the country of birth of an individual has persisted in a number of these European economies. Interestingly, we obtain differential impact on wages for EU versus non-EU migrants for all the years under study with the latter estimated to be much larger. Luxembourg, Italy, Cyprus, Ireland and Spain had the highest levels for the conditional wage gap between EU migrants and natives, while the UK, Belgium, Croatia, France and the Czech Republic offer higher hourly wages to migrants from EU countries compared to native-born employees, as shown in Figure 4. The conditional gap between non-EU migrants and native workers is quite large for Cyprus and Luxembourg, but is also relatively larger in Italy, Spain and Greece as shown in Figure 5. By contrast, Portugal, the Czech Republic, the UK, Croatia and Lithuania have the lowest conditional wage gap between non-EU migrants and native-born employees.

5 Robustness Checks

5.1 Heckman model without the exclusion restriction

In the Heckman model, it is highly desirable to impose at least one exclusion restriction in order to avoid collinearity problems in the second stage of Heckit. We have therefore included instruments such as marital status, number of dependent children and adults, benefits, health status and exogenous income. However, in this section, we examine the case where we do not include any exclusion restriction in the selection equation. Our results suggest that we do not have problems of severe collinearity because the inverse Mills ratio is non-linear over a wide rage of values. Table 6 illustrates the country-specific results regarding the misallocation index that arises from the wage gaps associated with the employment sector, gender, and migration status. Overall the results remain the same as in the case where we had included the instruments. Again, Cyprus, Luxembourg, Spain, Italy and Greece have the largest misallocation indexes, while Belgium, France, Croatia, United Kingdom and the Netherlands have the lowest.

5.2 Herfindahl-Hirschman index

The Herfindahl-Hirschman (HH) index is a common measure of market concentration that is used to determine market competitiveness. We use this idea to reconstruct the overall misallocation index. The HH-index is calculated for each country by squaring the coefficient of $Private$, $Female$, $MigrantEU$, and $Migrant$ and then summing the resulting numbers.[16]

Table 5 presents the HH-indices for each country averaged over the period from 2004 to 2015. Overall, the results are similar to before. Cyprus, Luxembourg, Spain and Italy are again found at the top of the overall talent misallocation index, while Belgium, France, the Netherlands and Croatia have the lowest indices. However, there are cases where the country ranking position changes somewhat. For example, Lithuania now replaces Greece and is now among the top five countries with the highest misallocation indices.

6 Conclusion

We have used EU SILC microeconomic data on wages and individual characteristics to detect patterns of misallocation arising in European countries based on public-private affiliation, individuals' gender, and immigration status. In our theoretical setting, wage differentials and talent misallocation are generated by differences in connectedness.[17]

[16] When the coefficient of the Private sector is negative we set it to zero as a negative parameter should not be interpreted as misallocation in this case, given the private sector's relative flexibility as compared to the public sector.

[17] Discrimination can also generate wage differentials. In fact, the empirical and theoretical results are compatible with discrimination as well. We can capture discrimination by replacing the existing probability of finding a job for an isolated worker $\gamma m(\theta)$, with $d\gamma m(\theta)$, where d is a parameter that captures discrimination (or imperfect transferability of human capital in the case of immigrants) or anything else that affects the probability of finding a job. This will generate wage differentials and hence talent misallocation.

In particular, we show that the lower the degree of connectedness, the higher the wage differential and the higher the misallocation.

Our empirical findings indicate that being a female or migrant and working in the private sector, holding other characteristics the same, exert a negative impact on hourly wages. As such unwarranted differences in earnings may imply misallocation in the economy with potentially important adverse effects for aggregate economic outcomes, we consider the aggregate country-level implications of our micro-based estimates. In the absence of data on differences in connectedness or direct numbers for talent misallocation, these wage differentials serve as an implicit index for talent misallocation.

Estimating misallocation indices for the private-public, migrant-native, and gender wage gaps in each country, we find that countries at the heart of the European Crisis have the highest totals. That our micro-based country-specific estimates using data on individuals across these European countries provides us with such an accurate mapping of aggregate country outcomes testifies to the usefulness of the approach pursued here in terms of understanding the deeper factors behind the aggregate inefficiency in these countries. Our micro-based estimated misallocation index placing these "problem" countries at the top, is consistent with talent misallocation having played a role in creating harmful inefficiencies in the smooth functioning of these economies that contributed to the problems they faced in the recent past. Our research provides new cross-country micro-econometric evidence in support of a surging new literature, including Hsieh et al. (2013), Jaimovich and Rud (2014), Cavalcanti and Tavares (2016), Santos and Cavalcanti (2015), and Cuberes and Teignier (2016), regarding the importance of various forms of talent misallocation for aggregate economic outcomes and economic growth.

Table 1: Selection-corrected hourly wage regression for the 2005 EU SILC wave

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Private	-0.121*** (0.015)	-0.086*** (0.014)	-0.091*** (0.007)	-0.120*** (0.010)	-0.097*** (0.012)	-0.095*** (0.013)
Female	-0.161*** (0.010)	-0.180*** (0.009)	-0.177*** (0.005)	-0.197*** (0.007)	-0.157*** (0.014)	-0.165*** (0.014)
MigrantEU	-0.055*** (0.024)	-0.041** (0.021)	-0.048*** (0.012)	-0.030 (0.019)	-0.022 (0.050)	-0.022 (0.050)
Migrant	-0.166*** (0.023)	-0.137*** (0.021)	-0.150*** (0.011)	-0.158*** (0.019)	0.023 (0.048)	0.025 (0.048)
educL	-0.185*** (0.014)	-0.131*** (0.013)	-0.134*** (0.007)	-0.148*** (0.024)	-0.151*** (0.024)	-0.147*** (0.024)
educH	0.355*** (0.010)	0.203*** (0.010)	0.202*** (0.005)	0.122*** (0.015)	0.119*** (0.015)	0.120*** (0.015)
age 35-44	0.104*** (0.013)	0.102*** (0.011)	0.110*** (0.006)	0.111*** (0.006)	0.112*** (0.006)	0.110*** (0.006)
age 45-54	0.141*** (0.014)	0.138*** (0.012)	0.151*** (0.006)	0.152*** (0.006)	0.152*** (0.006)	0.151*** (0.006)
age 55-64	0.202*** (0.015)	0.187*** (0.013)	0.185*** (0.007)	0.184*** (0.007)	0.184*** (0.007)	0.185*** (0.007)
Occup-b		0.062*** (0.011)	0.061*** (0.006)	0.063*** (0.006)	0.064*** (0.006)	0.064*** (0.006)
Occup-c		0.310*** (0.012)	0.314*** (0.006)	0.314*** (0.006)	0.315*** (0.006)	0.316*** (0.006)
Occup-d		0.436*** (0.016)	0.435*** (0.009)	0.439*** (0.009)	0.440*** (0.009)	0.440*** (0.009)
Part-time			-0.074*** (0.007)	-0.071*** (0.007)	-0.070*** (0.007)	-0.177*** (0.014)
Permanent			0.158*** (0.015)	0.163*** (0.015)	0.165*** (0.015)	0.158*** (0.015)
Private *educL				0.036 (0.024)	0.037 (0.024)	0.038 (0.024)
Private *educH				0.055*** (0.015)	0.059*** (0.015)	0.059*** (0.015)
Female *educL				-0.011 (0.012)	-0.007 (0.012)	-0.014 (0.012)
Female *educH				0.054*** (0.009)	0.055*** (0.009)	0.054*** (0.009)
MigrantEU *educL				-0.129*** (0.027)	-0.129*** (0.027)	-0.131*** (0.027)
MigrantEU *educH				0.029 (0.024)	0.029 (0.024)	0.029 (0.024)

Migrant *educL				-0.054*	-0.051*	-0.053*
				(0.028)	(0.028)	(0.028)
Migrant *educH				0.038	0.038	0.036
				(0.024)	(0.024)	(0.024)
Private *Female					-0.043***	-0.046***
					(0.014)	(0.014)
Private *MigrantEU					-0.009	-0.009
					(0.048)	(0.048)
Private *Migrant					-0.162***	-0.158***
					(0.046)	(0.046)
Female *MigrantEU					0.000	0.002
					(0.020)	(0.020)
Female *Migrant					-0.058***	-0.061***
					(0.020)	(0.020)
Female *Part-time						0.134***
						(0.015)
lambda	-1.036***	-0.932***	-0.377***	-0.338***	-0.320***	-0.342***
	(0.193)	(0.198)	(0.084)	(0.085)	(0.085)	(0.085)
Constant	2.834***	2.710***	2.523***	2.547***	2.521***	2.530***
	(0.028)	(0.028)	(0.023)	(0.024)	(0.025)	(0.025)
Total effect Private	-0.121***	-0.086***	-0.091***	-0.095***	-0.098***	-0.098***
	(0.009)	(0.014)	(0.007)	(0.007)	(0.007)	(0.008)
Total effect Female	-0.173***	-0.180***	-0.177***	-0.179***	-0.180***	-0.172***
	(0.006)	(0.009)	(0.005)	(0.005)	(0.005)	(0.005)
Total effect MigrantEU	-0.066***	-0.041**	-0.048***	-0.038***	-0.038***	-0.038***
	(0.014)	(0.021)	(0.012)	(0.012)	(0.012)	(0.012)
Total effect Migrant	-0.181***	-0.137***	-0.150***	-0.152***	-0.146***	-0.143***
	(0.014)	(0.021)	(0.011)	(0.012)	(0.012)	(0.012)
Observations	62,188	61,725	61,044	61,044	61,044	61,044

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 2: Selection-corrected hourly wage regression for the 2015 EU SILC wave

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Private	-0.104***	-0.083***	-0.080***	-0.097***	-0.076***	-0.074***
	(0.010)	(0.009)	(0.005)	(0.008)	(0.009)	(0.009)
Female	-0.195***	-0.195***	-0.181***	-0.195***	-0.161***	-0.168***
	(0.006)	(0.006)	(0.003)	(0.005)	(0.010)	(0.010)
MigrantEU	-0.120***	-0.098***	-0.102***	-0.148***	-0.135***	-0.133***
	(0.017)	(0.015)	(0.008)	(0.013)	(0.036)	(0.036)
Migrant	-0.179***	-0.148***	-0.145***	-0.169***	-0.031	-0.029
	(0.016)	(0.014)	(0.007)	(0.011)	(0.032)	(0.032)
educL	-0.196***	-0.150***	-0.148***	-0.135***	-0.136***	-0.135***
	(0.011)	(0.010)	(0.005)	(0.015)	(0.015)	(0.015)
educH	0.342***	0.188***	0.188***	0.131***	0.129***	0.129***
	(0.007)	(0.007)	(0.004)	(0.010)	(0.010)	(0.010)
age 35-44	0.139***	0.130***	0.132***	0.133***	0.133***	0.132***
	(0.011)	(0.010)	(0.005)	(0.005)	(0.005)	(0.005)
age 45-54	0.207***	0.191***	0.195***	0.196***	0.196***	0.195***
	(0.012)	(0.011)	(0.005)	(0.005)	(0.005)	(0.005)
age 55-64	0.241***	0.219***	0.222***	0.223***	0.223***	0.223***
	(0.013)	(0.011)	(0.005)	(0.005)	(0.005)	(0.005)
Occup-b		0.043***	0.040***	0.041***	0.042***	0.044***
		(0.008)	(0.004)	(0.004)	(0.004)	(0.004)
Occup-c		0.304***	0.298***	0.299***	0.299***	0.301***
		(0.009)	(0.005)	(0.005)	(0.005)	(0.005)
Occup-d		0.474***	0.462***	0.465***	0.465***	0.466***
		(0.015)	(0.008)	(0.008)	(0.008)	(0.008)
Part-time			-0.080***	-0.078***	-0.078***	-0.191***
			(0.005)	(0.005)	(0.005)	(0.011)
Permanent			0.179***	0.180***	0.180***	0.175***
			(0.009)	(0.009)	(0.009)	(0.009)
Private *educL				-0.016	-0.016	-0.014
				(0.015)	(0.015)	(0.015)
Private *educH				0.039***	0.043***	0.043***
				(0.010)	(0.010)	(0.010)
Female *educL				-0.002	-0.001	-0.006
				(0.009)	(0.009)	(0.009)
Female *educH				0.034***	0.033***	0.033***
				(0.007)	(0.007)	(0.007)
MigrantEU *educL				0.041**	0.044**	0.043**
				(0.020)	(0.020)	(0.020)
MigrantEU *educH				0.087***	0.085***	0.085***
				(0.017)	(0.017)	(0.017)

Migrant *educL				0.031*	0.032*	0.033**
				(0.017)	(0.017)	(0.017)
Migrant *educH				0.046***	0.045***	0.045***
				(0.015)	(0.015)	(0.015)
Private *Female					-0.037***	-0.042***
					(0.010)	(0.010)
Private *MigrantEU					-0.040	-0.040
					(0.035)	(0.035)
Private *Migrant					-0.124***	-0.122***
					(0.031)	(0.030)
Female *MigrantEU					0.047***	0.044***
					(0.015)	(0.015)
Female *Migrant					-0.040***	-0.044***
					(0.013)	(0.013)
Female *Part-time						0.143***
						(0.011)
lambda	-1.010***	-0.893***	-0.480***	-0.468***	-0.462***	-0.478***
	(0.178)	(0.156)	(0.056)	(0.056)	(0.056)	(0.056)
Constant	2.967***	2.848***	2.676***	2.695***	2.676***	2.682***
	(0.023)	(0.021)	(0.015)	(0.016)	(0.016)	(0.016)
Total effect Private	-0.104***	-0.083***	-0.080***	-0.084***	-0.089***	-0.088***
	(0.010)	(0.009)	(0.005)	(0.005)	(0.005)	(0.005)
Total effect Female	-0.195***	-0.195***	-0.181***	-0.181***	-0.182***	-0.175***
	(0.006)	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)
Total effect MigrantEU	-0.120***	-0.098***	-0.102***	-0.107***	-0.107***	-0.106***
	(0.017)	(0.015)	(0.008)	(0.008)	(0.009)	(0.009)
Total effect Migrant	-0.179***	-0.148***	-0.145***	-0.146***	-0.139***	-0.137***
	(0.016)	(0.014)	(0.007)	(0.007)	(0.008)	(0.008)
Observations	105,566	105,317	104,004	104,004	104,004	104,004

Note: Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3: Probit selection equation results

Variables	2005	2015
Private	-0.200***	-0.123***
	(0.048)	(0.033)
Female	-0.188***	-0.072***
	(0.026)	(0.019)
MigrantEU	-0.118*	-0.155***
	(0.063)	(0.045)
Migrant	-0.165***	-0.170***
	(0.053)	(0.035)
educL	-0.093***	-0.152***
	(0.036)	(0.026)
educH	0.042	0.066***
	(0.032)	(0.025)
age 35-44	0.173***	0.224***
	(0.031)	(0.025)
age 45-54	0.183***	0.258***
	(0.033)	(0.026)
age 55-64	-0.089**	0.128***
	(0.043)	(0.032)
Occup-b	-0.096***	0.004
	(0.033)	(0.025)
Occup-c	0.037	0.045*
	(0.036)	(0.027)
Occup-d	0.073	0.064
	(0.059)	(0.055)
Part-time	0.315***	0.442***
	(0.038)	(0.035)
Permanent	0.931***	0.769***
	(0.029)	(0.022)
Health	-0.255***	-0.274***
	(0.054)	(0.045)
Married	0.072***	0.089***
	(0.027)	(0.020)
dependn	-0.064***	-0.072***
	(0.015)	(0.011)
Benefits	-0.088***	-0.086***
	(0.033)	(0.025)
exg_inc	-0.003	-0.006*
	(0.005)	(0.003)
Constant	1.187***	1.499***
	(0.075)	(0.070)

Table 4: Talent Misallocation Index and its decomposition for the period 2004-2015

Countries	Private	Female	MigrantEU	Migrant	Misallocation Index
Cyprus	0.201	0.244	0.165	0.619	1.230
Luxembourg	0.117	0.091	0.232	0.375	0.816
Spain	0.176	0.160	0.130	0.221	0.688
Italy	0.125	0.127	0.173	0.228	0.653
Greece	0.063	0.165	0.124	0.191	0.544
Ireland	0.154	0.140	0.144	0.078	0.517
Austria	0.013	0.195	0.111	0.169	0.488
Iceland	0.012	0.218	0.095	0.141	0.466
Lithuania	0.177	0.270	-0.022	0.005	0.430
Finland	0.009	0.207	0.012	0.118	0.346
Norway	-0.045	0.224	0.045	0.077	0.301
Switzerland	0.085	0.129	0.005	0.079	0.298
Sweden	-0.045	0.202	0.007	0.134	0.298
Czech Republic	0.102	0.263	-0.036	-0.033	0.296
Portugal	0.178	0.127	0.007	-0.049	0.263
Netherlands	0.091	0.139	-0.036	0.036	0.230
United Kingdom	0.116	0.184	-0.050	-0.030	0.221
Croatia	0.121	0.132	-0.047	-0.009	0.197
France	0.010	0.157	-0.045	0.015	0.137
Belgium	-0.001	0.092	-0.050	0.057	0.097
Average	0.091	0.178	0.084	0.153	

Note: The table shows only countries that have information for at least half of the years (at least 6 years) and their indices are significant for at least half of the years provided. Thus Romania and Serbia have limited data, while the indices of Bulgaria, Denmark, Hungary, Poland and Slovakia are statistically significant for less of the years they provide information.

Table 5: Herfindahl-Hirschman Index for the period 2004-2015

Countries	Herfindahl-Hirschman Index
Cyprus	0.511
Luxembourg	0.217
Spain	0.123
Italy	0.114
Lithuania	0.105
Greece	0.083
Czech Republic	0.082
Austria	0.079
Iceland	0.076
Ireland	0.070
Sweden	0.059
Norway	0.058
Finland	0.057
United Kingdom	0.051
Portugal	0.050
Croatia	0.034
Switzerland	0.030
Netherlands	0.030
France	0.027
Belgium	0.014

Table 6: Indices derived from Heckman method without the exclusion restrictions

Countries	Private	Female	MigrantEU	Migrant	Misallocation Index
Cyprus	0.205	0.248	0.167	0.624	1.243
Luxembourg	0.119	0.095	0.237	0.377	0.828
Spain	0.180	0.165	0.135	0.226	0.706
Italy	0.126	0.130	0.179	0.229	0.664
Greece	0.065	0.168	0.126	0.192	0.551
Ireland	0.157	0.144	0.149	0.085	0.535
Austria	0.018	0.200	0.118	0.179	0.515
Iceland	0.016	0.222	0.102	0.157	0.498
Lithuania	0.184	0.269	-0.010	0.012	0.455
Finland	0.011	0.211	0.022	0.113	0.357
Norway	-0.041	0.230	0.049	0.083	0.322
Sweden	-0.040	0.208	0.009	0.140	0.318
Switzerland	0.085	0.132	0.006	0.081	0.304
Portugal	0.184	0.133	0.014	-0.043	0.287
Czech Republic	0.108	0.263	-0.054	-0.062	0.256
Netherlands	0.095	0.142	-0.032	0.040	0.245
United Kingdom	0.118	0.190	-0.046	-0.023	0.240
Croatia	0.117	0.146	-0.044	-0.006	0.213
France	0.013	0.159	-0.044	0.017	0.146
Belgium	0.003	0.098	-0.045	0.065	0.122
Average	0.093	0.183	0.085	0.149	

Figure 1: Talent Misallocation Index

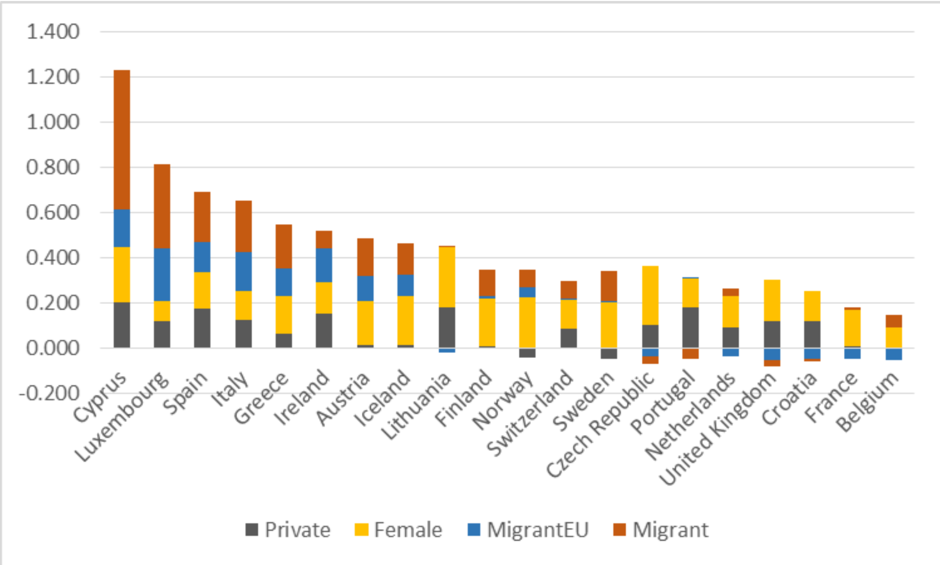


Figure 2: Private-Public sector wage gaps

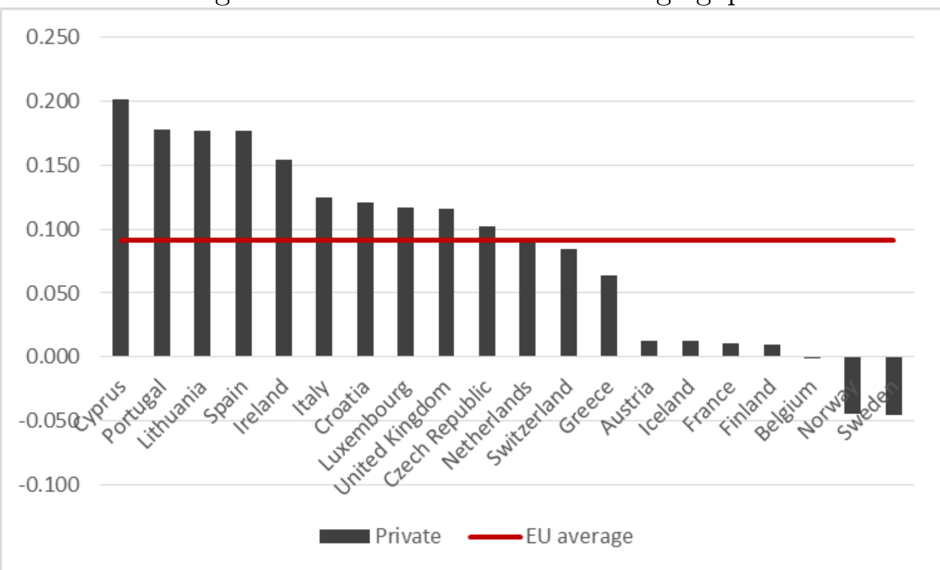


Figure 3: Gender wage gaps

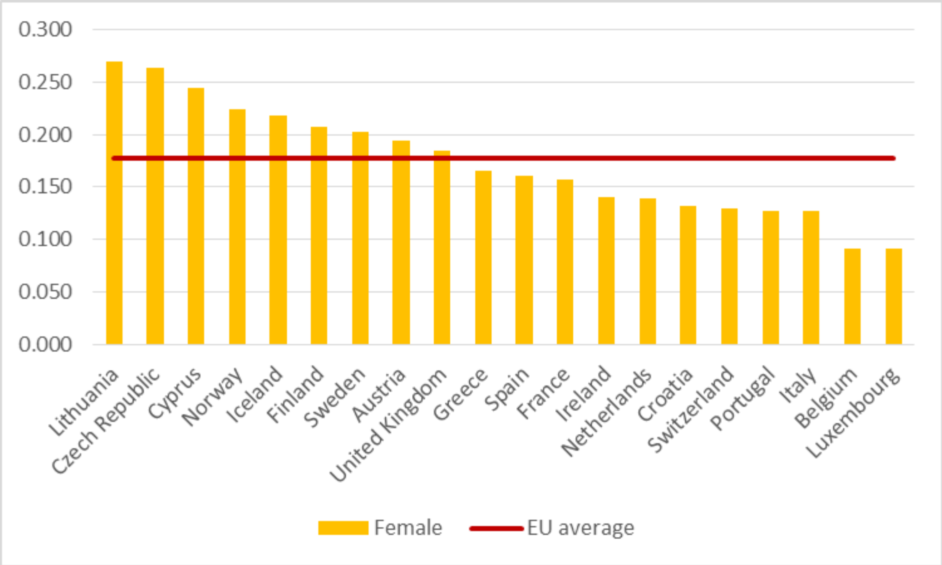


Figure 4: MigrantEU-Native wage gaps

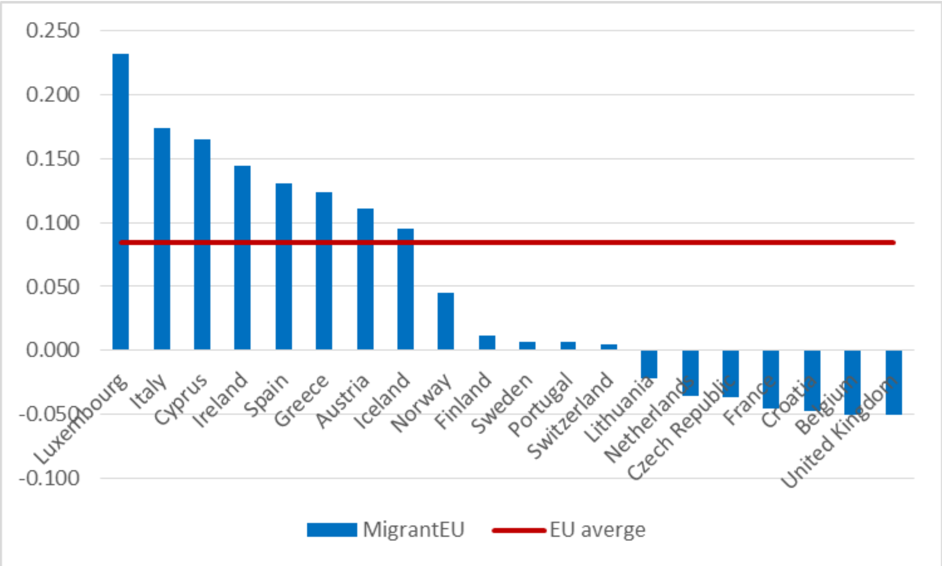
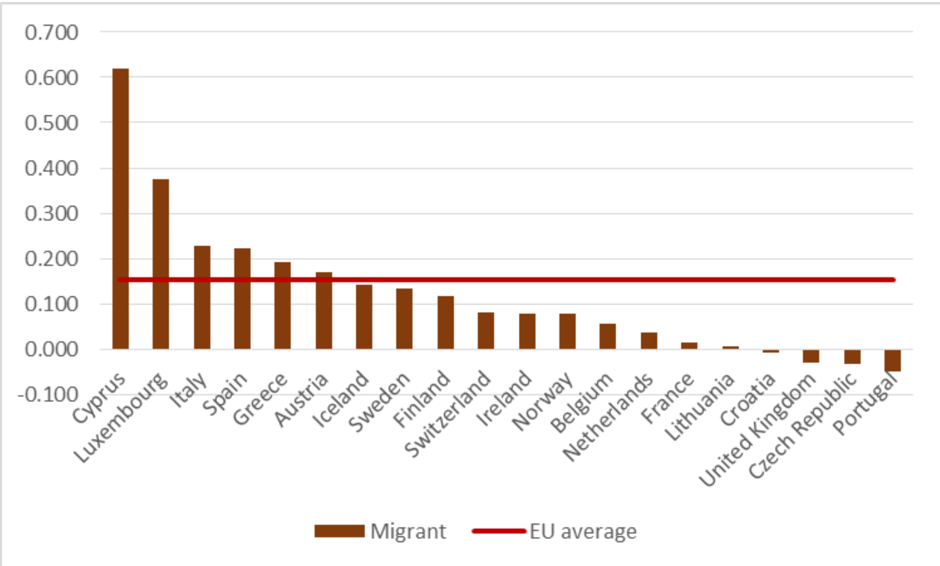


Figure 5: Migrant-Native wage gaps



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Appendix

Proof of Proposition 1. By way of contradiction, assume that all four types of matches are formed in equilibrium, that is $S_{ij} > 0 \ \forall i, j$. Given our assumption $y_H > y_L > b$, it follows that $\xi y_L + (1-\xi)y_H > b$ and hence, from (21) and (23), $U_C > U_I$. Then, from equations (18), we have $S_{HI} > S_{HC}$, $S_{LI} > S_{LC}$. Next, use (16) to rewrite equations (7) and (8) as

$$rV_L = -c + (1-\beta)q(\theta)[\phi S_{LI} + (1-\phi)S_{LC}]$$

$$rV_H = -c + (1-\beta)q(\theta)[\phi S_{HI} + (1-\phi)S_{HC}]$$

The definition of equilibrium requires that $V_L = V_H = 0$. This and the inequalities $S_{HI} > S_{LI}$ and $S_{HC} > S_{LC}$ lead to a contraction, since if $V_H = 0$ then $V_L < 0$. Thus, at least one of the generated surpluses and namely at least S_{LC} is non-positive. Thus, no matches between connected workers and low-productivity jobs will be formed in equilibrium.

Proof of Proposition 2. To be shown.

Proof of Proposition 3. Comparing (21) and (23), we see that $U_C > U_I$. Using this and equation (20), the result follows.

Proof of Proposition 4. The proof is similar to that of Proposition 1. Suppose not, i.e., suppose that there is an equilibrium in which low-productivity jobs are present. Given that $\gamma = 1$ and $y_H > y_L > 0$, it follows that $U_C = U_I$ and $S_{HC} = S_{HI} = S_H > S_{LC} = S_{LI} = S_L$. The free-entry conditions (13) then become

$$\frac{c}{(1-\beta)q(\theta)} = S_H$$

and

$$\frac{c}{(1-\beta)q(\theta)} = S_L$$

which is a contradiction.