Mind the gaps: Job and gender effects of migration on FDI*

Federico Carril-Caccia[1], Ana Cuadros[2] and Jordi Paniagua[†3,4]

[1]University of Granada

[2]Universitat Jaume I and Institute of International Economics

[3]University of Valencia, Department of Applied Economics II

[4]Kellogg Institute, University of Notre Dame

January 2022

Abstract

The paper develops a model to estimate the elasticity of substitution between male and female labor from FDI and migration data. Using the structural gravity equation, which resolves most of the known empirical biases, the paper provides accurate estimates of the elasticity of substitution for managers (3.2), professionals (2.1), and non-qualified (6.0). However, aggregation and discrimination biases are theoretically relevant and quantitatively significant. The paper's insights are relevant to understand better the effects of migration and FDI and design policies that target increasing female labor participation.

Keywords— FDI, migration, elasticity of substitution, gender
JEL— F21, F22, F23

*The authors gratefully acknowledge financial support from the Research Challenges Programme of MICINN (Spanish Government & FEDER) through grants RTI2018-100899-B-I00 and RTI2018-100983-B-100; Universitat Jaume I (OPI02A/19 and UJI-B2019-15), the Generalitat Valenciana (GV/2020/012) and from the Kellogg Institute for International Studies (University of Notre Dame). We thank Rob Johnson, Taryn Dinkelman, Jeffrey Bergstrand and the attendants of the Development Economics Seminar of the University of Notre Dame, and the USITC economics webinar for the useful comments and suggestions.

†Corresponding author jordi.paniagua@uv.es

1 Introduction

3.2 million years ago, Lucy, a female specimen is an early australopithecine, had an idea that would change humankind: to stand upright and walk. Bipedalism preceded a human's increase in brain size since it imposed physiological changes on women's hips that reduced the birth canal, forcing babies to be born immature with a soft skull or fontanel. Childbearing was, therefore, a much more intensive task for Lucy than for her predecessors, and she probably had the second most powerful idea in humankind: specialization and trade, which over time arose productivity differentials for some tasks between men and woman. More recently, Loujain al-Hathloul, a Saudi women's rights activist, was arrested for defying the ban on women driving in Saudi Arabia, which was lifted in 2018. One year later, only 70,000 Saudi women were issued driver's licenses.

The story of these two women separated by millennia hits right on one of the central insights of this paper: the elasticity of substitution between female and male labor varies with the type of labor and with the extent of gender gap or discrimination in the labor market. It is commonly accepted that female and male labor are imperfect substitutes. However, in contrast to the ample estimates of the elasticity of substitution between skilled and unskilled labor[1],, only a handful of estimates of the elasticity of substitution between female and male labor. Using US data from the 1940s, Acemoglu et al. (2004) report an elasticity of substitution between 2 and 5. With more recent Italian data, De Giorgi et al. (2015) estimate an implied elasticity of substitution ranging between 1.0 and 1.4.

To the best of our knowledge, there are no estimates by labor type (e.g., skilled vs. non-skilled) or the extent of the gender gap or discrimination in the labor market. Ignoring these factors induces aggregation and misallocation bias in the elasticity estimates. On the one hand, aggregating skilled and unskilled labor underestimates the elasticity of substitution: replacing a low-skilled man with a high-skilled woman is much more complicated than if both are high-skilled or low-skilled. On the other hand, In high

[1]See, for example, Havranek et al. (2020) for a meta-analysis

gender-gap countries, replacing the less productive men with more productive women might improve market efficiency and reduce resource misallocation (Besley et al., 2017; Hsieh et al., 2019). Therefore, in countries where the female participation rate is inefficiently low, the elasticity of substitution should be higher than in countries with low discrimination. The first female taxi driver in Saudi Arabia, for example, could probably out-perform the two or three most mediocre men taxi drivers.

Therefore, precise estimates of the elasticity of substitution between female and male labor are relevant to evaluate the effects of policies targeted to increase female participation in the labor market. For example, the International Organization for Migration (2017), in the scope of the UN 2030 Agenda, advocates for "migration policies in both countries of origin and destination are formulated, with due regard for the particular needs and experiences of migrant women and girls (...) by organizing programmes for admission of foreign workers specialized in particular fields [that] encourage and enable women to accede to areas such as corporate leadership". However, little is known of the potential effect of these policies on aggregate economic outcomes and their effect on the incumbent (men) workers in heterogeneous labor markets.

This paper seeks to answer two questions: What is the effect of increasing female labor participation in market outcomes? What is the effect on male labor? To do so, we focus on a particular labor market: migrants, and a specific outcome: Foreign Direct Investment (FDI). This setting allows us to use a well-established relationship (migration-FDI link) with a bullet-proof empirical method (structural gravity) to focus on three novel contributions to the literature: i) Introducing an additional channel by which migration enhances FDI, ii) developing a theoretically and empirically sound method to estimate the elasticity of substitution without wages data, and ii) providing estimates of the elasticity of substitution between male and female labor for three job types (managers, professionals, and non-qualified) in high- and low- gender gap countries.

The model adapts labor models with male and female workers (Acemoglu et al., 2004; De Giorgi et al., 2015) to the context of migration & FDI (Cuadros et al., 2019) and includes resource misallocation via gender discrimination (Cavalcanti and Tavares, 2016;

Restuccia and Rogerson, 2017). We use FDI data from FDIMarkets and migration data from the DIOC-E dataset, from which we build a panel of OECD countries during 2003-2016. We deal with endogeneity with a shift-share approach using a relevant feature of structural gravity: domestic flows (Yotov et al., 2021). Structural gravity allows us to identify the effect of country-specific migration flows, which allows us to show that the effect of migrants on FDI is labor-related and independent of the information channel.

Our estimates reveal that the implied elasticity of substitution is 1.3 on average. However, the elasticity of managers (3.2), professionals (2.1), and non-qualified (6.0) reveals the aggregation bias in crude estimates of the elasticity of substitution. We find that the elasticity of substitution between male and female workers is lower in low gender-gap countries than in high gender-gap countries. For validity, we used this novel estimation procedure to estimate the implied estimate of the elasticity of substitution between skilled and non-skilled labor is 1.4, in line with the well-known estimates in the literature (1.5).

The rest of the paper is organized as follows. Section 2 reviews briefly the literature, Section 3 presents the theoretical model that drives the estimation strategy presented in section 4, section 5 presents the empirical results, and section 6 concludes.

2 Background: migration and FDI

A rise in international migration has accompanied globalization and, since the 1990s, it has also been characterized by an increasing share of women (Benería et al., 2012; Docquier et al., 2012). According to United Nations' migration statistics, in 2017, almost 50% of the world's migrant stock were women. In diverse countries such as the United States, Italy, Russia, Poland, Uruguay, or Uganda, inward women migrant stock is above 50%. Mirroring this trend, outward women migrants are also the majority in numerous countries compared to men (e.g., Thailand, Canada, Finland, Paraguay, or Kenya). Besides, the female share of international high-skilled migration is rising due to the increase in women's educational attainment, the increased demand for women's

labor in health care and the service sectors, and the changes in attitudes towards female migration (Docquier et al., 2012). Gender influences reasons for migrating, who migrates and where, the networks they use, opportunities and resources available at destinations, and relations with the country of origin.

Despite these tendencies, the gendered assessment of the effects of migration has been chiefly overlooked (Dumont et al., 2007; Pfeiffer et al., 2007), and more specifically, their effect on FDI. The literature four identified three channels by which migration affects FDI. The first is the information channel; migrants provide valuable transnational information that bridges informational frictions between home and host countries. The majority of previous work has focused on the educational attainment of migrants to emphasize the importance of considering migrants heterogeneity (see Docquier and Lodigiani (2010); Flisi and Murat (2011); Javorcik et al. (2011); Kugler and Rapoport (2007); Tomohara (2017)).. Other studies focused on the type of information. For example, Cuadros et al. (2016) showed that financial information was relevant during the Great Recession.

The second channel is the network channel. This channel relies on the information advantage of migrants and strong family and cultural ties with their homeland (see Buch et al. (2006); Burchardi et al. (2019); Cuadros et al. (2019), among others). The consideration of migrants' gender can be somewhat relevant for several reasons. The network channel seems to be stronger for educated migrants as this type of migrants brings their higher level of information and influence. Well-educated individuals may have specialized knowledge about conducting business with investors of their particular ethnicity. They also have the language skills and cultural sensitivity to promote collaboration with business developers in host countries. Besides, skilled migrants are likely to have a more in-depth understanding of customer behavior and can provide insights about the type of products that would generate higher demand levels.

However, the role played by migrants' educational attainment is controversial: Felbermayr and Jung (2009) find that low- and high-skilled migrants boost bilateral trade while medium-skilled migration does not seem to matter. This could be explained by the mismatch between formal educational attainment and job skills, which is a general com-

mon feature of the labor market and seems to be particularly pronounced for migrants. Migrants are more likely than native-born workers to be either under-or over-educated regarding the jobs they hold (Aleksynska and Tritah, 2013; Chiswick and Miller, 2009).

The third channel is a labor/job channel. A large stock of migrant labor might increase productivity and reduce labor costs for foreign affiliates. Cuadros et al. (2019) pioneered the attempt (in a multi-country gravity framework) to account for the controversial evidence referred above by considering the role played by migrants' occupations in influencing FDI. These authors conclude that those individuals born in the investors' home/host country occupying managerial or professional positions in the host/home country of investment have an enhancing effect on FDI. Their approach relies on the evidence obtained by a handful of migration-trade studies which advocate using migrants' job position rather than education as a suitable proxy for the migrants' adequate job skill-sets and decision-making power (Aleksynska and Havrylchyk, 2013; Martín-Montaner et al., 2014). Migrants' proximity to decision-making positions appears to have a more crucial influence on international trade than their formal knowledge or abilities. Such professionals have a direct role in channeling relevant information and knowledge of potential export markets and import opportunities and understanding differences in culture and business practices (Mundra, 2014). Moreover, there will be a greater exchange of ideas across managerial and professional immigrant groups, which increases the potential for lowering transaction costs through access to more extensive information about foreign markets and personal business contacts.

However, Cuadros et al. (2019) could not disentangle labor from information effects, which is relevant for this paper. A fundamental assumption to estimate an implied elasticity of substitution is that migration affects FDI via wages. We show an information-independent effect of migration by estimating the effect of all other migrants working in the host country, except those from the home country of the affiliate. This group's positive effect, which does not possess information on the FDI's home country, suggests an information-independent, labor-related channel, in line with Cuadros et al.'s (2019) theory.

In light of these channels, there are three ways the migrant's gender might affect FDI differently. Firstly, female and male networks' quality and type of information may differ (Docquier et al., 2012; Ruyssen and Salomone, 2018). Previous work has already illustrated the relevance of the network channel through which migrants may help overcome informational barriers and thus promote foreign investments. The importance of social networks as a mechanism that facilitates migration may be different for men and women because the costs, risks, and benefits of migration differ by gender (Curran and Rivero-Fuentes, 2003). Generally speaking, migration is a family-based decision, and people migrate not only to maximize their income but also to minimize their migration risks (Gheasi and Nijkamp, 2017). Social networks seem to be more critical for women who rely more strongly on relatives and friends for help, information, protection, and guidance at their destination.

Secondly, the labor market, flexibility, and technology affect the relative male and female productivity (Goldin, 2014, 2021). For example, Goldin and Katz (2016) show that pharmacists' knowledge is codified, explaining why pharmacy is a female-majority profession with a small gender earnings gap and low earnings dispersion. In contrast, finance or management is at the opposite flank with highly tacit knowledge, making it a highly masculine profession (Goldin, 2021).

Lastly, the third reason to consider the gender dimension is discrimination. Previous literature on labor markets and discrimination finds differences in the economic returns to human capital between men and women. The key argument is that these costs and benefits are likely to be gender-specific. Thus, a model that pools men and women can be justified if the parameters reflecting how explanatory variables affect migration do not vary by gender (Pfeiffer et al., 2007). Hsieh et al. (2019) have recently shown that a substantial pool of innately talented women and black men in 1960 were not pursuing their comparative advantage. According to these authors, the change in occupational distribution since 1960 suggests that the resulting misallocation of talent could potentially have relevant aggregate consequences. Cavalcanti and Tavares (2016) quantify the effect of this discrimination on output.

Several papers document a selection bias in migration that responds to discrimination. Low-skilled women might be less likely to migrate due to discrimination or social or family concerns (Docquier et al., 2012), thereby influencing estimations about the connection between migration and FDI. According to Ruyssen and Salomone (2018), women who do not feel treated with respect and dignity have a higher incentive to migrate abroad. However, the likelihood of these migration intentions turning into actual plans depends on more traditional determinants such as household income, network effects, and family obligations.

3 Theoretical model

3.1 Setup

The basic setup follows closely Cuadros et al. (2019): a world of J countries with the assumption of a Cobb-Douglas utility function for a representative consumer $U_j = X_{NTj}^{\mu} X_{Tj}^{1-\mu}$, for a two-sector economy with NT (non-traded) and T (traded) goods. The parameter μ is the share of total spending R_j in each industry, which consists of a continuum of differentiated products. The aggregate consumption in this sector is the sum of all goods produced. The term X_{Tj} is a standard CES aggregator across the continuum of products (l): $X_j = \left[\int x_j(l)^{\iota} dl\right]^{1/\iota}$, where $\sigma \equiv (1-\iota)^{-1} > 1$ is the elasticity of substitution between any two products. The maximization of the demand of the good l is $x_j(l) = \frac{p_j^{-\sigma} Y_j}{P_j^{1-\sigma}}$, where $Y_j \equiv (1-\mu)R_j$, p_j is the price of the good and P_j the price index in the traded sector $P_j = \left[\int_l {p_j}^{1-\sigma} dl\right]^{1/(1-\sigma)}$.

3.2 Foreign Production

Production is undertaken by price-taking firms in monopolistic competition. To produce the good l, a firm from country i in country j uses two inputs: capital K, and labor L_j, which are local workers with "j" skills, the type of skills found in the host country. The firm also requires L_{ij} are workers with "ij" skills (i.e., common language), to translate blueprints form country "i". Differently from Cuadros et al. (2019), we asume that these

workers increase the total factor productivity. To model production, we use a Cobb-Douglas CES production function:

$$x_{ij} = A(L_{ij})[K_{ij}^{k} L_{j}^{l}] \tag{1}$$

where the positive constants $k + l < 1$ measure the intensity with which the inputs are used in production and are constant, K is capital, $A(L_{ij}) > 1$ is TFP, K is capital, L_{ij} are workers with "ij" skills (i.e., common language) and L_j are workers with "j" skills. In domestic firms $A(L_{ij}) = 1$.

Upon entry, the firm discovers its total factor productivity $1/\alpha$, where α is the number of input units per input bundle used by the firm to produce one unit of output. We follow the standard assumption that the distribution of α across firms is continuous Pareto c.d.f. $G(\alpha)$ with $[\underline{\alpha}, \bar{\alpha}]$. The density of $G(\alpha)$ is denoted by $g(\alpha)$ and the distribution is the same across countries.

To produce a good, a domestic firm incurs a marginal cost of:

$$mc = \alpha(w_{ij} L_{ij} + r_j K_{ij} + w_j L_j) \tag{2}$$

where each unit of capital comes at a cost of $r_j > 1$, which reflects the capital, interest and search costs. The "ij"-skilled and "j" labor costs (coordination costs and wages) are, respectively, $w_{ij} > w_j > 1$. This assumption is based on the fact that "ij" skills are relatively less abundant than "j"-skilled skill sets.

Following Cuadros et al. (2019), we can show that the optimal relative foreign capital needed for production is:

$$K_{ij}^{FDI} = \left(\frac{1}{w_{ij}/w_j}\right)^{\frac{1}{1-\mu}} \left(\frac{\alpha^*}{\alpha}\right) K_j^{Dom}(\alpha^*) \tag{3}$$

where α^* is the productivity threshold to enter the market, $\mu = l + k$ and K_j^{Dom} is the optimal equilibrium for capital for local firms given by:

$$K_j^{Dom} = \left(\frac{Y_j^{1/\sigma}}{P_j^{(1-\sigma)/\sigma}} \frac{k}{\alpha r_j^{1-\eta+k} \left(\frac{k}{l} w_j\right)^l} \right)^{\frac{1}{1-\mu}}. \tag{4}$$

3.3 Multiple firms and FDI gravity equation

The capital investment is defined as the sum of the capital invested from the most productive firm $\underline{\alpha}$ to the least productive foreign firm α^*.

$$\tilde{K}_{ij} = N_i \int_{\underline{\alpha}}^{\alpha^*} K_{jz}^{FDI} \frac{g(\alpha)}{G(\alpha^*)} d\alpha = \\ = N_i K_j^{Dom}(\bar{\alpha}) \left(\frac{1}{w_{ij}/w_j} \right)^{\frac{1}{1-\eta}} \int_{\underline{\alpha}}^{\alpha^*} \left(\frac{\bar{\alpha}}{\alpha} \right)^{\frac{1}{1-\eta}} \frac{g(\alpha)}{G(\alpha^*)} d\alpha, \tag{5}$$

where N_i is the total number of firms in country i.

To calculate the foreign capital invested by foreign firms, we follow the assumptions of Helpman et al. (2008), adapted for FDI in Cuadros et al. (2016), to obtain a log-linear and estimable equation from (5):

$$\ln FDI_{ij} \equiv \ln \tilde{K_{ij}} \quad = \quad n_i + k_j - \ln \bar{w}_{ij} + \omega_{ij}, \tag{6}$$

where $n_i = \ln N_i$ and $k_j = \ln K_j^{Dom}(\bar{\alpha})$ are home and host country fixed effects, respectively, $\bar{w}_{ij} = \left(\frac{w_{ij}}{w_j}\right)^{\frac{1}{1-\eta}}$ the wage share, and ω_{ij} is a country-parameter that controls selection. Equation 6 is effectively a gravity equation for foreign capital, where the total foreign capital investment is the result of home country fixed effects (the number of firms or the country's economic mass), a host country fixed effect (minimum capital requirements determined by the host's factor endowments and demand via prices), a bilateral transaction cost that includes selection into an investment mechanism.

3.4 Male and female labor

Consider that labor is composed of male (M) and female (F) workers in a standard CES function (Acemoglu et al., 2004; De Giorgi et al., 2015)[2]:

$$L_{ij} = \left(\theta_M L_{ijM}^{\rho} + \theta_F L_{ijF}^{\rho}\right)^{\frac{1}{\rho}}, \tag{7}$$

where $\rho \leq 1$, M are male and F are female workers, and $\theta_M + \theta_F = 1$ are a gender-dependent productivity parameters, $\sigma_{MF} \equiv {}^{1}/_{(1-\rho)}$ is the elasticity of substitution between female and male workers.

Associated with this CES labor function, the labor costs are now:

$$\bar{w}_{ij} = \bar{w}_{ijM}^{\theta_M} \bar{w}_{ijF}^{\theta_F} = \bar{w}_{ijM} \left(\frac{\bar{w}_{ijF}}{\bar{w}_{ijM}}\right)^{\theta_F}. \tag{8}$$

The FOC (the marginal product of male and female labor) imply that the female to men wage ratio can be expressed (in logs) as:

$$\ln\left(\frac{\bar{w}_{ijF}}{\bar{w}_{ijM}}\right) = -\ln\left(\frac{L_{ijM}}{L_{jM}}\right) + \ln\left(\frac{\theta_F}{\theta_M}\right) - \frac{\theta_F}{\sigma_{MF}} \ln\left(\frac{L_{ijF}}{L_{ijM}}\right) \tag{9}$$

And since $\ln \bar{w}_{ijM} = \ln\left(\frac{1/L_{ijM}}{1/L_{jM}}\right)$, we can express the FDI gravity equation as:

$$\ln FDI_{ij} = \lambda_i + \lambda_j + \omega_{ij} + \ln\left(\frac{L_{ijM}}{L_{jM}}\right) - \ln\left(\frac{\theta_F}{\theta_M}\right) + \frac{\theta_F}{\sigma_{MF}} \ln\left(\frac{L_{ijF}}{L_{ijM}}\right) \tag{10}$$

We have effectively constructed an FDI equation that allows us to recover σ_{MF} estimating labor shares against capital.

3.5 Gender misallocation

To model gender misallocation, we assume that a distortion $\tau \geq 0$ raises women's marginal product labor concerning men's, as in Cavalcanti and Tavares (2016). Discrimination is a wedge between women's Marginal Product of Labor (MPL) and their

[2]For simplicity, we only consider this distinction in for "ij" without loss of generality.

salary. The nature of this misallocation is not relevant in this model, but in the literature, it usually stems from labor market distortions, flexibility, and technology affecting the relative male and female productivity (Goldin, 2014, 2021).

Consider that some countries have a gender gap ($\tau > 0$ for some j). In this case, allocation is inefficient and some countries face higher costs to hire women. Men's $M'sMPL = \omega$ and Women's MPL $W'sMPL = \omega(1+\tau)$ jointly determine M and W.

Countries with gender discrimination have inefficiently low W:

$$W'sMPL = (1+\tau)\omega^{GP} > \omega^*$$

where ω^* is the equilibrium labor cost for woman in the absence of missallocation ($\tau = 0$) and ω^{GP} is the gender-gap wage. In countries with high gender discrimination, woman labor is a scare resource and labor costs are higher. For example, a the Saudi cab company that wanted hire women and faced an extra burden due to the women's driving ban (licenses, fees, uniforms).

The market clears allowing unemployed women to migrate to other countries without discrimination and offer the lower equilibrium wage $\omega^{GP} = \frac{\omega^*}{1+\tau} < \omega^*$. Woman's salary falls so that other firms absorb more woman labor:$w^{GP} < w^*$. In gendered constrained countries, most firms are gender constrained and will have have inefficiently low F, affecting the estimates of σ. Therefore, we can re-write equation 9 as:

$$\ln\left(\frac{\bar{w}_{ijF}}{\bar{w}_{ijM}}\right) = -\ln\left(\frac{L_{ijM}}{L_{jM}}\right) + \ln\left(\frac{\theta_F}{\theta_M}\right) - \frac{\theta_F}{\sigma}\ln\left(\frac{L_{ijF}}{L_{ijM}}\right) + \ln\tau_j,$$

and the gravity equation as:

$$\ln FDI_{ij} = \lambda_i + \lambda_j + \omega_{ij} + \ln\left(\frac{L_{ijM}}{L_{jM}}\right) - \ln\left(\frac{\theta_F}{\theta_M}\right) + \frac{\theta_F}{\sigma_{MF}}\ln\left(\frac{L_{ijF}}{L_{ijM}}\right) - \ln\tau_j \quad (11)$$

As highlighted in Table 1, the shares are very similar in for domestic and migrant

Table 1: Job and gender shares for migrants by domestic an migration labor

					Hi Gender Gap	
	Migra	Dom	F Migra θ^F	F Dom	F Migra	F Dom
Total			0.451	0.451	0.456	0.442
Managers	0.121	0.084	0.348	0.326	0.334	0.359
Professionals	0.515	0.553	0.398	0.358	0.395	0.349
Non-qualified	0.357	0.363	0.577	0.624	0.595	0.597

labor. Therefore, we believe that an approximation of using migrant labor shares in the regression is valid.

Therefore, we can express the labor ratio as:

$$\ln\left(\frac{L_{ijF}}{L_{ijM}}\right) = \ln\psi + \epsilon_{ij} = \ln\left(\frac{\text{Migra}_{ijF}}{\text{Migra}_{ijM}}\right) + \epsilon_{ij}, \tag{12}$$

where ϵ_{ij} is an error term.

and the labor shares as:

$$\ln\left(\frac{L_{ijM}}{L_{jM}}\right) = \ln\left(\frac{\text{Migra}_{ijF}}{L_{jM}}\right) \equiv \ln\left(\text{MigraSh}_{ijM}\right) \tag{13}$$

Now substituting 12 and 13 in 11, we obtain an empirical equation to estimate:

$$\ln FDI_{ij} = \lambda_i + \lambda_j + \omega_{ij} + \ln\left(\text{MigraSh}_{ijM}\right) - \ln\left(\frac{\theta_F}{\theta_M}\right) + \frac{\theta_F}{\sigma_{MF}}\ln\psi - \ln\tau_j + \epsilon_{ij} \tag{14}$$

We use the migrant female labor shares in Table 1, as our parameter θ^F to calculate σ_{FM}.

4 Empirical strategy

4.1 Structural gravity

We rely on recent advances in the structural gravity model to estimate equation 14. Structural gravity contains several elements that stem directly from theory and deliver

estimates free from known empirical biases. Yotov et al. (2016) outline six basic recommendations: i) Use panel data, ii) Allow for Adjustment in Trade Flows [3], iii) Include Intra-national Trade Flows (Yotov et al., 2021), iv) Use Directional Time-varying Fixed Effects (i.e., origin-time and destination-time fixed effects) (Bergstrand and Egger, 2007), v) Employ Country-Pair Fixed Effects (not strictly need from theory, but convenient to control for endogeneity and all time-invariant bilateral trade costs), vi) Estimate Gravity with PPML to avoid heteroskedasticity, zero trade flows and ensures that the gravity fixed effects are identical to their corresponding structural terms (Fally, 2015; Silva and Tenreyro, 2006).

The first shot at an empirical equation that best capture all the gravity elements to estimate the effects of migration on FDI is:

$$FDI_{ijt} = \exp\left(\begin{array}{c} \beta_1 \underbrace{\ln \text{MigraSh}_{jit-4}}_{\text{information}} + \beta_2 \underbrace{\ln \text{MigraSh}_{ijt-4M}}_{\downarrow\text{Network \&}\uparrow\text{labor}} \\ + \beta_3 \underbrace{\ln \psi_{ijt}}_{\text{gender}} + \\ + \lambda_{it} + \lambda_{jt} + \lambda_{ij} + \chi_{ijt} \end{array}\right) \times e_{ijt}. \tag{15}$$

where FDI_{ijt} is the greenfield investment flows country i to country j in year t, including domestic investments (from country i to country i). The effect of migration is decomposed into three different channels. Firstly, the information channel, captured by $\ln \text{MigraSh}_{jit-4}$, the log of share stock of migrants from country j living in country i. These migrants can transmit information, but cannot reduce labor costs for the affiliate in the host country. Secondly, the network and labor channel, which is captured by $\ln \text{MigraSh}_{ijt-4M}$, the share of male migrants from country i living in country j. The equation includes a full set of origin-year, destination-year and country-pair fixed effects. Finally, the gravity equation contains a set of controls and fixed effects. χ_{ijt} is a set of bilateral time-variant variables, which include dummies which take one whenever a pair of countries have signed Free Trade Agreement (FTA) and Bilateral investment Treaty

[3] More recently, Egger et al. (2021) recommend the use of annual data instead of yearly intervals

(BIT).

Equation 15 allows us to compute the elasticity of substitution with

$$\hat{\sigma}_{MF} = \frac{\theta^F}{\hat{\beta}_3}$$

wher use the migrant female labor shares in Table 1 as values for θ^F .

The estimates delivered by equation 15 do not fully tackle aggregation and discrimination biases in $\hat{\sigma}_{MF}$ and endogeneity concerns. To this end, we estimate three separate equation for each Job={Manager, Professional, Non-qual} and interact the migration ratios with a measure of high gender gap in the host country country:

$$FDI_{ijt} = \exp\left(\left(\begin{array}{c} \beta_1 \underbrace{\ln \text{MigraSh}_{jit-4}}_{\text{information}} + \beta_2 \underbrace{\ln \text{MigraSh}^{\text{Job}}_{ijt-4M}}_{\downarrow\text{Network \&}\uparrow\text{labor}} \\ + \beta_3 \underbrace{\ln \psi^{\text{Job}}_{ijt-4}}_{\text{gender}} + \beta_4 \underbrace{\ln \psi^{\text{Job}}_{ijt} \times \tau_j}_{\text{discrimination}} \end{array}\right) \times BRDR_{ij} + \lambda_{it} + \lambda_{jt} + \lambda_{ij} + \chi_{ijt} + BRDR_{ij} \times t\right) \times e_{ijt} \quad (16)$$

where τ_j is a dummy variable that takes the value of 1 if country j is a high gender-gap country and $BRDR_{ij}$ is an international border dummy that takes the value of 1 when country i and j are different countries and 0 otherwise.

The inclusion of the international border dummy provides and exogenous shift to the shares estimates. Therefore, the shift-share estimates should be exogenous (Nizalova and Murtazashvili, 2016). Additionally the migration variables are lagged in order to reduce the potential harmful simultaneity between FDI and migration (Bratti et al., 2014; Cuadros et al., 2019; Peri and Requena-Silvente, 2010).

One important advantage of using intra-national flow data is the identification of the effects of country-specific variables. The inclusion of origin-time and destination-time fixed effects renders coliniearity with any other country-specific variable. That means, that we cannot estimate directly the impact of the total stock of migration from all origins

living in the host country. However, the interaction between country-specific variables and a border dummy ($BRDR_{ij}$) is not colinear with the country fixed effects (Beverelli et al., 2018; Heid et al., 2021). This way, we can identify the effects of all the the rest of migrants who, as discussed before, do not have strong information signaling:

Particularly, we estimate the following equation:

$$FDI_{ijt} = \exp\left(\left(\begin{array}{c} \underbrace{\ln \text{MigraSh}_{jit-4}}_{\text{information}} + \underbrace{\ln \text{MigraSh}_{ijt-4}}_{\downarrow\text{Network \&}\uparrow\text{labor}} \\ \underbrace{\ln\left(\sum_i \text{MigraSh}^{\text{Job}}_{ijt-4M} - \text{MigraSh}^{\text{Job}}_{ijt-4M}\right)}_{\text{labor}} + \underbrace{\ln \psi^{\text{Job}}_{jt-4}}_{\text{gender}} \end{array}\right) \times BRDR_{ij} + \lambda_{it} + \lambda_{jt} + \lambda_{ij} + \chi_{ijt}\right) \times e_{ijt}, \tag{17}$$

where $\ln \text{MigraSh}^{\text{Job}}_{j\neq it-4} = \ln\left(\sum_i \text{MigraSh}^{\text{Job}}_{ijt-4M} - \text{MigraSh}^{\text{Job}}_{ijt-4M}\right)$.

Estimating 17 is interesting from two perspectives. Firstly, it is a novel attempt at estimating the effect of country-specific effects of migration. Secondly, it can shed some light on the differences between the channels by which migration affects FDI. Bilaterality is relevant for the information channel as the migrant ability to transmit information depends highly on translational skills and characteristics. However, models that rely on labor channels rest on migration as a valuable labor resource. Migrants from diverse origins could also have similar effects on reducing labor costs without the information signaling.

4.2 Data description and sources

The present study relies on FDIMarket greenfield investment data from 2003-2016. Our estimates rely on the count of foreign projects. For the domestic investment, we rely on the number of firms created during a year from World Bank's Ease of Doing Business report[4]. As shown in our robustness analysis, this data imputation does not affect our

[4]The number of firms created during a year is a statistic which starts in year 2006, year that we use to input the extensive margin's domestic investment in 2004. As it is shown in our robustness analysis,

results. Data on bilateral migration stocks by sex and job skills for 2001, 2005, and 2011 is retrieved from the OECD's Database on Immigrants in OECD Countries (DIOC). Following Cuadros et al. (2019), intending to keep the United States in the sample, we group migrants' jobs occupations into three groups: Managers, professionals, and non-qualified (see table 2).

Table 2: Jobs skills groups classification

Job skills groups	2-Digit ISCO-88
Manager	Legislators, Senior officials and Managers
	Professionals, Technicians and associate professionals
Professional	Skilled agricultural and fishery workers
	Plant and machine operators and assemblers
non-qualified	Clerks
	Elementary occupations

Among employed migrants in OECD countries, there are substantial gender differences in job-skill. Figure 1 shows that female migrants with managerial positions are a minority, representing in 2011 only 10.7% of the total (with a decreasing trend). In contrast, the share of female migrants with a professional or non-qualified job has significantly increased between 2001 and 2011. In 2011, on average, 53% and 58.8% of the migrants, which have a professional and a non-qualified job, respectively, were female. Table 3 illustrates that at least 70% of the migrant managers are male in all countries for which data is available. Alternatively, women mostly dominate professional and non-qualified jobs. These data show cross-section and time variation in our variables of interest, enabling a panel estimation. The limitation of migrant data availability is overcome by interpolating the missing years. [5]

Control variables FTA are retrieved from World Bank (Hofmann et al., 2017) and BIT from UNCTAD investment monitor. The remaining bilateral time-invariant independent variables included in the gravity model are retrieved from CEPPII (Head et al., 2010).

Measuring gender inequality is challenging and still open to debate (e.g. Barns and

this data imputation does not affect our results.

[5]We have tested several specifications, without any significant effect on the estimates

Figure 1: Gender differences in migrants occupation

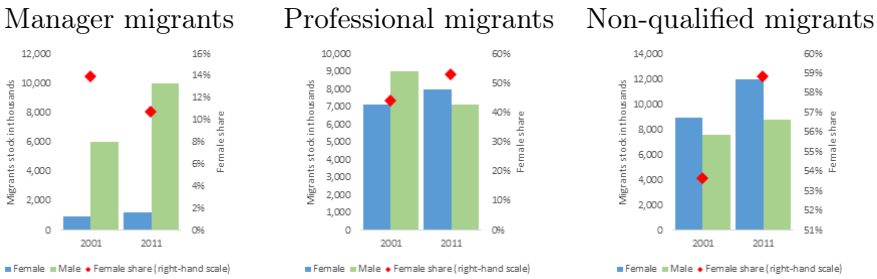


Table 3: Average share of female inward migrants stock by profession

	Manager	Professional	Non-qualified
Australia	21.7%	53.7%	54.9%
Austria	18.8%	49.5%	61.4%
Belgium	15.0%	52.2%	51.2%
Canada	21.0%	56.3%	57.6%
Chile	23.4%	48.0%	54.6%
Czech Republic	18.9%	43.4%	37.5%
Denmark	13.8%	53.3%	63.1%
Estonia	27.0%	40.9%	39.1%
Finland	11.3%	47.9%	50.6%
France	27.8%	57.0%	60.5%
Germany	21.9%	47.3%	53.4%
Greece	25.0%	48.0%	58.3%
Hungary	20.0%	47.1%	43.5%
Iceland	24.6%	53.4%	57.6%
Ireland	27.2%	47.1%	51.2%
Israel	13.6%	51.9%	68.7%

	Manager	Professional	Non-qualified
Italy	20.0%	53.6%	62.9%
Luxembourg	26.7%	54.2%	54.0%
Mexico	24.4%	43.2%	34.8%
Netherlands	29.7%	52.6%	56.8%
New Zealand	28.2%	53.5%	52.8%
Norway	13.1%	34.5%	79.4%
Poland	16.0%	49.0%	29.9%
Portugal	28.3%	52.4%	52.2%
Slovak Republic	24.6%	46.2%	39.1%
Slovenia	26.2%	52.4%	50.7%
Spain	19.5%	44.4%	54.1%
Sweden	11.4%	51.4%	66.1%
Switzerland	20.1%	57.3%	57.2%
United Kingdom	25.5%	54.7%	60.1%
United States	18.6%	54.8%	56.4%

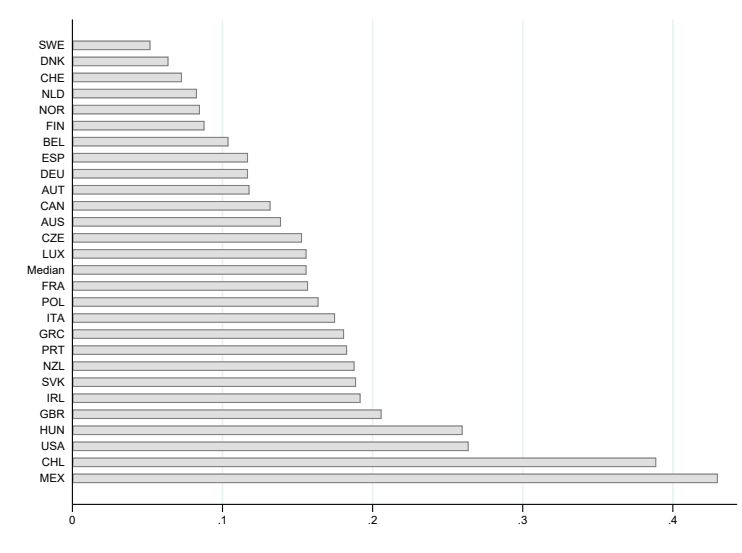
Preston, 2010; Dijkstra and Hanmer, 2000; Permanyer, 2010, 2013), but it is central for empirically testing the implications of the proposed theoretical model in section 3.1. Thus, the present study relies on two different indicators: Hofstede's Masculinity index (MAS) (Hosftede, 1980) and the Gender Inequality Index (GII) from United Nations Development Programme (UNDP, 2010) in year 2005. Besides their different approach for measuring gender inequality, which confers robustness to our empirical analysis, these indicators have been widely used by the previous literature on the implications of gender inequality (e.g. Audette et al., 2019; Hahn and Bunyaratavej, 2010; Pickbourn and Ndikumana, 2016).

The MAS index (masculinity vs femininity) attempts to gauge if values usually related to men or women are predominant in a society. Masculinity is associated with the preference for "*achievement, heroism, assertiveness and material rewards for success*" while Femininity represents a preference for "*cooperation, modesty, caring for the weak and quality of life*" [6]. The GII measures the differences between men and women in terms of three dimensions of human development: reproductive health, empowerment and economic status.

Figures 2, and 3 present the values that each country in the sample has in respectively the GII and MAS indexes. As it can be gathered, the group of countries which are above the indexes' median varies, thus in the empirical analysis the list of countries considered as with high gender inequality is not completely homogeneous. Nevertheless, there same several countries which are considered as with high inequality by two of the three indexes, and countries like Poland, Mexico, Chile, Hungary, Italy and Slovakia are classified in the three considered indexes as countries with high inequality. All in all, as illustrated by figure 4, it is quite important to highlight that the present analysis focuses on countries whose gender inequality is relatively low in comparison with the rest of the world. Countries which occupy the first places in terms of gender inequality are not included in our analysis.

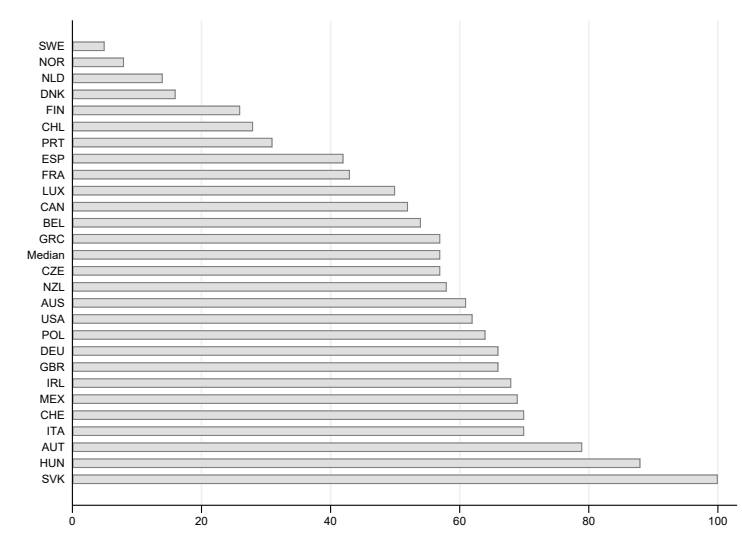
[6] Definition retrieved from Hofstede Insights: https://hi.hofstede-insights.com/

Figure 2: United Nations Development Programme Gender Inequality Index (GII) in 2005



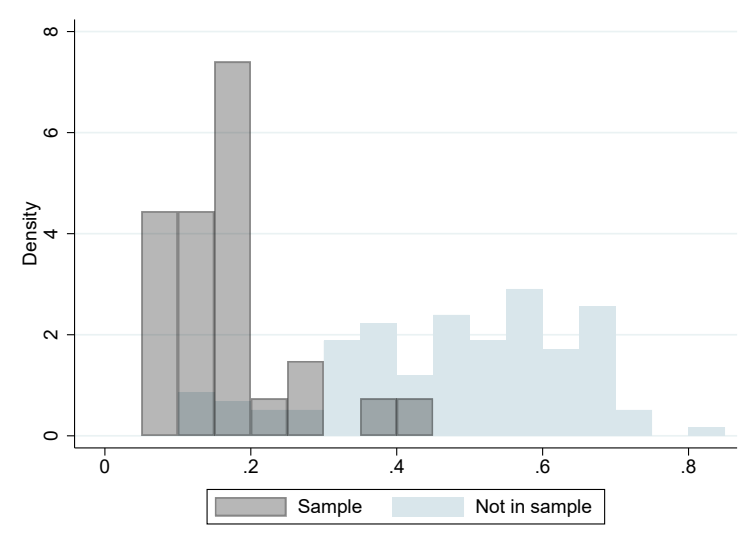
Authors' own elaboration. The index goes from 0 (full equality) to 1 (full inequality).

Figure 3: Hofstede's masculinity-femininity index



Authors' own elaboration. The index goes from 0 (full femininity) to 100 (full masculinity).

Figure 4: Comparison of GII between countries included and not included in the sample



Authors' own elaboration. The index goes from 0 (full equality) to 1 (full inequality). Data from year 2005.

5 Results

5.1 Bilateral migration

Several interesting traits surface in the baseline results from estimating equation 15 are reported in Table 4. Firstly, increasing female participation in migrant shares has a positive and significant effect on FDI. Secondly, the implied elasticity of substitution between female and male labor is greater than one, suggesting that men and women are imperfect substitutes. Thirdly, $\hat{\sigma}_{MF}$ is lower for the total sample than for the individual jobs, highlighting the aggregation bias discussed earlier.

Table 4: Bilateral migration by occupation and gender

	(1) Total	(2) Manager	(3) Professional	(4) Non-qual
$\hat{\sigma}_{MF}$	2.3	3.2	3.0	18.6
$\ln \text{MigraSh}_{jit-4}$	0.024	0.024	0.043	0.067
	(0.05)	(0.04)	(0.05)	(0.05)
$\ln \text{MigraSh}^{\text{Job}}_{ijt-4M}$	0.210***	0.171***	0.135**	0.015
	(0.06)	(0.04)	(0.05)	(0.05)
$\ln \psi^{\text{Job}}_{ijt}$	0.194**	0.111**	0.134**	0.031
	(0.08)	(0.05)	(0.06)	(0.05)
Observations	6479	6479	6479	6479
CountryxYear FE	Yes	Yes	Yes	Yes
Country-Pair FE	Yes	Yes	Yes	Yes

PPML, Robust s.e. in (), clustured by CP. Controls: BIT, FTA, BRDBxYear

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The estimates reported in Table 5 repeat the same exercise as in Table 4, but each variable now interacts with the international border dummy. Therefore the interpretation of the coefficients is their effect relative to the base category, in this case, domestic investment. The shift-share treatment has the effect of inflating the estimates of the female to male ratio, thus reducing the implied $\hat{\sigma}_{MF}$. Our estimate for the aggregate elasticity of substitution (1.3) lies in the range reported by De Giorgi et al. (2015): between 1.0 and 1.5 for Italian labor. The $\hat{\sigma}_{MF}$ are larger for the individual jobs. Since

the estimate of the effect of non-qualified migrant shares is more precise, we obtain a much more sensible approximation of $\hat{\sigma}_{MF}$ (6.0) than in Table 4 with the exogenous shift. It is interesting to notice that professionals, which is a very diverse category, have the lowest $\hat{\sigma}_{MF}$. Therefore, we suspect that there is still some over-aggregation bias for professionals. It is challenging to substitute a male IT technician for a female fishery worker.

Table 5: Bilateral migration by occupation and gender × BRDR

	(1) Total	(2) Manager	(3) Professional	(4) Non-qual
$\hat{\sigma}_{MF}$	1.3	3.2	2.1	6.0
$\ln \text{MigraSh}_{jit-4} \times BRDR_{ij}$	0.035	0.034	0.050	0.072
	(0.05)	(0.04)	(0.05)	(0.05)
$\ln \text{MigraSh}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$	0.225***	0.168***	0.147***	0.037
	(0.06)	(0.04)	(0.05)	(0.05)
$\ln \psi^{\text{Job}}_{ijt} \times BRDR_{ij}$	0.335***	0.109**	0.186***	0.096**
	(0.08)	(0.05)	(0.06)	(0.05)
Observations	6479	6479	6479	6479
CountryxYear FE	Yes	Yes	Yes	Yes
Country-Pair FE	Yes	Yes	Yes	Yes

PPML, Robust s.e. in (), clustured by CP. Controls: BIT, FTA, BRDBxYear
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As highlighted by the results reported in Table 6, gender discrimination imposes a substantial and significant bias the implied estimates of $\hat{\sigma}_{MF}$. Consistently, the $\hat{\sigma}_{MF}$ is lower in those countries with a low masculinity index than in countries with a high masculinity index. By the estimate of the aggregate $\hat{\sigma}_{MF} = 0.7$, we could be led to the conclusion that male and female labor are compliments in low gender-gap countries. This would imply that male labor is also benefited from policies that increase female participation in the labor force. However, this conclusion is driven again by an aggregation bias. The estimates for each occupation reveal that $\hat{\sigma}_{MF} > 1$ in all cases. However, managers and professionals are close to being perfect substitutes in this case. Therefore, gender equality in these countries would be close to Pareto efficient from the point of

view of incumbent men.

Table 6: Bilateral migration by occupation and gender × BRDR ×τ MAS

MAS	(1) Total	(2) Manager	(3) Professional	(4) Non-qual
$\hat{\sigma}_{MF}$	0.7	1.2	1.1	4.3
$\hat{\sigma}_{MF} \times \tau_j$	2.8	3.8	3.9	5.9
$\ln \text{MigraSh}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$	0.212***	0.211***	0.147***	0.031
	(0.06)	(0.06)	(0.05)	(0.05)
$\ln \psi^{\text{Job}}_{ijt} \times BRDR_{ij}$	0.628***	0.283***	0.379***	0.134**
	(0.14)	(0.10)	(0.10)	(0.06)
$\ln \psi^{\text{Job}}_{ijt} \times BRDR_{ij} \times \tau_j$	-0.465***	-0.192*	-0.277**	-0.035*
	(0.16)	(0.05)	(0.12)	(0.02)
Observations	6479	6479	6479	6479
CountryxYear FE	Yes	Yes	Yes	Yes
Country-Pair FE	Yes	Yes	Yes	Yes

PPML, Robust s.e. in (), clustured by CP. Controls: BIT, FTA, BRDBxYear $\ln \text{Migra}_{jit-4}$

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.2 Country-specific migration

In the next set of tables within this subsection, we focus on providing evidence of the mechanisms in place, along with further implied estimates of $\hat{\sigma}_{MF}$. Table 7 is, to the best of our knowledge, the first to report results of the effect of country-specific migration by estimating a gravity equation with a complete set of fixed effects. The results suggest that the share of the total stock of migration in a country significantly affects bilateral FDI flows. Further, when we decompose the effect into bilateral migration shares and the aggregate shares from all origins, the effect is larger and more significant in the latter. This means that countries with a larger labor force attract multinational firms. However, a high-skilled labor force with bilateral "ij" skills (managers and lower-level professionals) has a premium. It is revealing to observe that while non-qualified "ij" migration shares have no significant effect on FDI, having a large pool of "j" migrant labor force has a positive and significant effect on FDI.

Table 7: Country-specific migration by occupation

	(1)	(2)	(3)	(4)
	Total	Manager	Professional	Non-qual
$\ln \text{MigraSh}^{\text{Job}}_{jt-4} \times BRDR_{ij}$	0.485***	0.529***	0.522***	0.391***
	(0.06)	(0.09)	(0.06)	(0.05)
$\ln \text{MigraSh}^{\text{Job}}_{ijt-4} \times BRDR_{ij}$	0.140**	0.161***	0.093*	0.030
	(0.06)	(0.05)	(0.05)	(0.05)
$\ln \text{MigraSh}^{\text{Job}}_{j\neq it-4} \times BRDR_{ij}$	0.321***	0.399***	0.345***	0.306***
	(0.06)	(0.09)	(0.07)	(0.05)
Observations	6479	6479	6479	6479
CountryxYear FE	Yes	Yes	Yes	Yes
Country-Pair FE	Yes	Yes	Yes	Yes

PPML, Robust s.e. in (), clustured by CP. Controls: BIT, FTA, BRDBxYear $\ln \text{Migra}_{jit-4}$

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We can further estimate the implied $\hat{\sigma}_{MF}$ for "j" migrants, and the results are reported in Table 7. The results reveal lower $\hat{\sigma}_{MF}$ for "j" migrants than for "ij" migrants. Again, these values might hide some aggregation bias, as we allow substituting male and female labor from many different origins. The values are close and lower than 1, implying that male and female labor are close to being perfect substitutes on aggregate terms (we cannot reject that those values are statistically different from 1).

Table 8: Country-specific migration by occupation and gender

	(1) Total	(2) Manager	(3) Professional	(4) Non-qual
$\hat{\sigma}_{MFj}$	0.9	0.8	0.8	0.9
$\ln \text{MigraSh}^{\text{Job}}_{ijt-4} \times BRDR_{ij}$	0.127*	0.151***	0.310***	0.018
	(0.06)	(0.04)	(0.12)	(0.05)
$\ln \text{MigraSh}^{\text{Job}}_{jt-4M} \times BRDR_{ij}$	0.284***	0.139	0.094*	0.275***
	(0.07)	(0.11)	(0.05)	(0.05)
$\ln \psi^{\text{Job}}_{jt} \times BRDR_{ij}$	0.484*	0.470**	0.489	0.621***
	(0.26)	(0.20)	(0.35)	(0.21)
Observations	6479	6479	6479	6479
CountryxYear FE	Yes	Yes	Yes	Yes
Country-Pair FE	Yes	Yes	Yes	Yes

PPML, Robust s.e. in (), clustured by CP. Controls: BIT, FTA, BRDBxYear $\ln \text{Migra}_{jit-4}$

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.3 Robustness and validity

We finish our empirical analysis by providing robustness and validity checks. In Table 9 we perform two different analyses. Firstly, we consider the case where gender-equality policies are targeted at shifting the composition of migrant shares. For example, policies that increase the share of female manager visas at the expense of other types. To do so, we introduce the stock of migrants and the share of managers, and the female to male ratio. The results reveal that the effect and the implied elasticity of substation are very similar to our baseline specification.

Table 9: Country-specific migration by occupation and gender

	(1) Manager	(2) Professional	(3) Skilled
$\hat{\sigma}_{MF}$	3.1	3.4	
$\hat{\sigma}_S$			1.4
$\ln \text{MigraSh}_{ijt-4M} \times BRDR_{ij}$	0.262***	0.192***	0.597***
	(0.07)	(0.07)	(0.13)
$\ln \text{Share}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$	0.136**	0.389**	
	(0.06)	(0.17)	
$\ln \psi^{\text{Job}}_{ijt} \times BRDR_{ij}$	0.111**	0.117*	
	(0.05)	(0.06)	
$\ln {}^{\text{Skilled}}/_{\text{No Qual}_{ijt}} \times BRDR_{ij}$			0.472***
			(0.15)
Observations	6479	6479	6479
CountryxYear, CP FE	Yes	Yes	Yes

PPML, Robust s.e. in (), clustured by CP. Controls: BIT, FTA, BRDBxYear $\ln \text{Migra}_{jit-4}$

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results of the exercise in Column 3 of Table 9 are relevant to increase the validity of our approach. It is a well-documented fact that most of the elasticity of substitution between skilled and non-skilled labor "range between 1.3 and 2.5, with a consensus estimate around 1.5." (Cantore et al., 2017, p. 80). When we apply our method to estimate the substitution between skilled (managers and professionals) and non-skilled labor (non-qualified), we obtain a value of 1.4.

Lastly, we use the GII index instead of the MAS for robustness. The estimates of Table 10 using the GII index are qualitatively similar to those using the MAS index in Table 6, with some quantitative differences.

Table 10: Country-specific migration by occupation and gender

GII	(1) Total	(2) Manager	(3) Professional	(4) Non-qual
$\hat{\sigma}_{MF}$	0.5	5.2	2.1	6.1
$\hat{\sigma}_{MF} \times \tau_j$	1.8	6.8	2.2	6.0
$\ln \text{MigraSh}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$	0.208***	0.146***	0.147***	0.037
	(0.06)	(0.04)	(0.05)	(0.05)
$\ln \psi^{\text{Job}}_{ijt} \times BRDR_{ij}$	0.830***	0.067	0.194*	0.096*
	(0.23)	(0.07)	(0.10)	(0.06)
$\ln \psi^{\text{Job}}_{ijt} \times BRDR_{ij} \times \tau_j$	-0.574**	-0.015	-0.011	0.000
	(0.24)	(0.09)	(0.11)	(0.02)
Observations	6479	6479	6479	6479
CountryxYear, CP FE	Yes	Yes	Yes	Yes
BRDRxYear	Yes	Yes	Yes	Yes

PPML, Robust s.e. in (), clustured by CP. Controls: BIT, FTA, BRDBxYear $\ln \text{Migra}_{jit-4}$

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11 summarizes the estimates of $\hat{\sigma}_{MF}$.

Table 11: Summary of results

	(1) Total	(2) Manager	(3) Professional	(4) Non-qual
$\hat{\sigma}_{MF}$	1.3 ***	3.2 *	2.1***	6.0**
$\hat{\sigma}_{MF} \times \tau_j = 0$	0.7 ***	1.2**	1.1***	4.3**
$\hat{\sigma}_{MF} \times \tau_j = 1$	2.8 ***	3.8 **	3.9 **	5.9**
$\hat{\sigma}_{MFj}$	0.9*	0.8**	0.8	0.9***

6 Conclusions

This paper contributes to four main areas. Firstly, it provides a method to estimate the elasticity of substitution between male and female labor from FDI and migration data. A practical contribution behind this approach is that we do not need to observe wages to estimate the elasticity of substitution.

Secondly, it leans the structural gravity equation, which resolves most of the known empirical biases, to provide accurate estimates of the elasticity of substitution. These estimates might come in handy for calibrating models with these heterogeneous agents. Thirdly, it provides evidence in favor of an information-independent, labor-related channel behind the effect of migration and FDI.

Lastly, the paper is relevant in designing policies targeted at increasing female labor participation. The paper shows that aggregation and discrimination biases are theoretically relevant and quantitatively significant. Therefore, broad labor or migration policies might have undesired effects.

References

Acemoglu, D., Autor, D. H., and Lyle, D. (2004). Women, war, and wages: The effect of female labor supply on the wage structure at midcentury. *Journal of political Economy*, 112(3):497–551.

Aleksynska, M. and Havrylchyk, O. (2013). FDI from the south: The role of institutional distance and natural resources. *European Journal of Political Economy*, 29:38–53.

Aleksynska, M. and Tritah, A. (2013). Occupation–education mismatch of immigrant workers in europe: Context and policies. *Economics of Education Review*, 36:229–244.

Audette, A. P., Lam, S., O'Connor, H., and Radcliff, B. (2019). (e) quality of life: A cross-national analysis of the effect of gender equality on life satisfaction. *Journal of Happiness Studies*, 20(7):2173–2188.

Barns, A. and Preston, A. (2010). Is australia really a world leader in closing the gender gap? *Feminist Economics*, 16(4):81–103.

Benería, L., Diana Deere, C., and Kabeer, N. (2012). Gender and international migration: Globalization, development, and governance. *Feminist Economics*, 18(2):1–33.

Bergstrand, J. H. and Egger, P. (2007). A knowledge-and-physical-capital model of international trade flows, foreign direct investment, and multinational enterprises. *Journal of International Economics*, 73(2):278 – 308.

Besley, T., Folke, O., Persson, T., and Rickne, J. (2017). Gender quotas and the crisis of the mediocre man: Theory and evidence from sweden. *American economic review*, 107(8):2204–42.

Beverelli, C., Keck, A., Larch, M., and Yotov, Y. (2018). Institutions, trade and development: a quantitative analysis. *CESifo Working Paper Series*, (WP 2018-03).

Bratti, M., De Benedictis, L., and Santoni, G. (2014). On the pro-trade effects of immigrants. *Review of World Economics*, 150(3):557–594.

Buch, C. M., Kleinert, J., and Toubal, F. (2006). Where enterprises lead, people follow? Links between migration and FDI in Germany. *European Economic Review*, 50(8):2017–2036.

Burchardi, K. B., Chaney, T., and Hassan, T. A. (2019). Migrants, ancestors, and foreign investments. *The Review of Economic Studies*, 86(4):1448–1486.

Cantore, C., Ferroni, F., and Leon-Ledesma, M. A. (2017). The dynamics of hours worked and technology. *Journal of Economic Dynamics and Control*, 82:67–82.

Cavalcanti, T. and Tavares, J. (2016). The output cost of gender discrimination: A model-based macroeconomics estimate. *The Economic Journal*, 126(590):109–134.

Chiswick, B. R. and Miller, P. W. (2009). The international transferability of immigrants' human capital. *Economics of Education Review*, 28(2):162–169.

Cuadros, A., Martín-Montaner, J., and Paniagua, J. (2016). Homeward bound fdi: Are migrants a bridge over troubled finance? *Economic Modelling*, 58:454–465.

Cuadros, A., Martín-Montaner, J., and Paniagua, J. (2019). Migration and fdi: The role of job skills. *International Review of Economics & Finance*, 59:318–332.

Curran, S. R. and Rivero-Fuentes, E. (2003). Engendering migrant networks: The case of mexican migration. *Demography*, 40(2):289–307.

De Giorgi, G., Paccagnella, M., and Pellizzari, M. (2015). Gender complementarities in the labor market. *Research in Labor Economics*, 41:277–298.

Dijkstra, A. G. and Hanmer, L. C. (2000). Measuring socio-economic gender inequality: Toward an alternative to the undp gender-related development index. *Feminist economics*, 6(2):41–75.

Docquier, F. and Lodigiani, E. (2010). Skilled migration and business networks. *Open Economies Review*, 21(4):565–588.

Docquier, F., Marfouk, A., Salomone, S., and Sekkat, K. (2012). Are skilled women more migratory than skilled men? *World development*, 40(2):251–265.

Dumont, J.-C., Martin, J., and Spielvogel, G. (2007). Women on the move: The neglected gender dimension of the brain drain. Technical report, Institute of Labor Economics (IZA).

Egger, P., Larch, M., Nigai, S., and Yotov, Y. (2021). Trade costs in the global economy: Measurement, aggregation and decomposition. Technical report, WTO Staff Working Paper.

Fally, T. (2015). Structural gravity and fixed effects. *Journal of International Economics*, 97(1):76–85.

Felbermayr, G. J. and Jung, B. (2009). The pro-trade effect of the brain drain: Sorting out confounding factors. *Economics Letters*, 104(2):72–75.

Flisi, S. and Murat, M. (2011). The hub continent. immigrant networks, emigrant diasporas and fdi. *The Journal of Socio-Economics*, 40(6):796–805.

Gheasi, M. and Nijkamp, P. (2017). A brief overview of international migration motives and impacts, with specific reference to fdi. *Economies*, 5(3):31.

Goldin, C. (2014). A grand gender convergence: Its last chapter. *American Economic Review*, 104(4):1091–1119.

Goldin, C. (2021). *Career and Family: Women's Century-Long Journey Toward Equity.* Princeton University Press.

Goldin, C. and Katz, L. F. (2016). A most egalitarian profession: pharmacy and the evolution of a family-friendly occupation. *Journal of Labor Economics*, 34(3):705–746.

Hahn, E. D. and Bunyaratavej, K. (2010). Services cultural alignment in offshoring: The impact of cultural dimensions on offshoring location choices. *Journal of Operations Management*, 28(3):186–193.

Havranek, T., Irsova, Z., Laslopova, L., and Zeynalova, O. (2020). The elasticity of substitution between skilled and unskilled labor: A meta-analysis.

Head, K., Mayer, T., and Ries, J. (2010). The erosion of colonial trade linkages after independence. *Journal of international Economics*, 81(1):1–14.

Heid, B., Larch, M., and Yotov, Y. V. (2021). Estimating the effects of non-discriminatory trade policies within structural gravity models. *Canadian Journal of Economics/Revue canadienne d'économique*, 54(1):376–409.

Helpman, E., Melitz, M., and Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *The Quarterly Journal of Economics*, 123(2):441–487.

Hofmann, C., Osnago, A., and Ruta, M. (2017). Horizontal depth: a new database on the content of preferential trade agreements. *Policy Research working paper*, WPS 7981.

Hosftede, G. (1980). *Culture's Consequences, International Differences in Work-Related Values (Cross Cultural Research and Methodology).* Sage, Newbury Park, California, United States.

Hsieh, C.-T., Hurst, E., Jones, C. I., and Klenow, P. J. (2019). The allocation of talent and us economic growth. *Econometrica*, 87(5):1439–1474.

Javorcik, B. S., Özden, Ç., Spatareanu, M., and Neagu, C. (2011). Migrant networks and foreign direct investment. *Journal of Development Economics*, 94(2):231–241.

Kugler, M. and Rapoport, H. (2007). International labor and capital flows: Complements or substitutes? *Economics Letters*, 94(2):155–162.

Martín-Montaner, J. A. M., Silvente, F. R., and Domingo, G. S. (2014). International trade and migrant networks: Is It really about qualifications? *Estudios de economía*, 41(2):251–260.

Mundra, K. (2014). Immigration and trade creation for the United States: role of immigrant occupation. *The International Trade Journal*, 28(4):311–343.

Nizalova, O. Y. and Murtazashvili, I. (2016). Exogenous treatment and endogenous factors: Vanishing of omitted variable bias on the interaction term. *Journal of Econometric Methods*, 5(1):71–77.

Peri, G. and Requena-Silvente, F. (2010). The trade creation effect of immigrants: evidence from the remarkable case of spain. *Canadian Journal of Economics/Revue canadienne d'économique*, 43(4):1433–1459.

Permanyer, I. (2010). The measurement of multidimensional gender inequality: Continuing the debate. *Social Indicators Research*, 95(2):181–198.

Permanyer, I. (2013). A critical assessment of the undp's gender inequality index. *Feminist Economics*, 19(2):1–32.

Pfeiffer, L., Richter, S., Fletcher, P., and Taylor, J. E. (2007). Gender in economic research on international migration and its impacts: a critical review. *The international migration of women*, pages 11–51.

Pickbourn, L. and Ndikumana, L. (2016). The impact of the sectoral allocation of foreign aid on gender inequality. *Journal of International Development*, 28(3):396–411.

Restuccia, D. and Rogerson, R. (2017). The causes and costs of misallocation. *Journal of Economic Perspectives*, 31(3):151–74.

Ruyssen, I. and Salomone, S. (2018). Female migration: A way out of discrimination? *Journal of Development Economics*, 130:224–241.

Silva, J. M. C. S. and Tenreyro, S. (2006). The log of gravity. *Review of Economics and Statistics*, 88(4):641–658.

Tomohara, A. (2017). Does immigration crowd out foreign direct investment inflows? Tradeoff between contemporaneous FDI-immigration substitution and ethnic network externalities. *Economic Modelling*, 64:40–47.

UNDP (2010). Human development report 2010: The real wealth of nations - pathways to human development. United Nations Development Programme, New York.

Yotov, Y. et al. (2021). The variation of gravity within countries. Technical report, LeBow College of Business, Drexel University.

Yotov, Y. V., Piermartini, R., Monteiro, J.-A., and Larch, M. (2016). *An advanced guide to trade policy analysis: The structural gravity model*. World Trade Organization Geneva.