Mind the gaps:
Gender complementarities in migration and FDI*

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Abstract

This paper analyzes the effect of increasing the share of female migrants on Foreign Direct Investment (FDI). We develop a model that introduces gendered labor and discrimination in a structural model of FDI. Our estimates reveal that the increasing feminization of the immigration labor force is positively associated with FDI. Furthermore, the model disciplines the quantification of the elasticity of substitution between male and female labor for 27 OECD countries (1.3 on average) and three job types: managers (3.2), professionals (2.1), and non-qualified workers (6.0). The elasticity of substitution is lower in countries with low gender gaps (e.g., 0.3 in Sweden) than in countries with high gender gaps (e.g., 6.1 in Mexico). Our analysis offers novel perspectives on the impacts of migration and the potential implications of policies targeted at enhancing female workforce participation.

Keywords— FDI, migration, elasticity of substitution, gender, discrimination

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1 Introduction

According to United Nations' migration statistics, almost half of the world's migrants are women. In some countries (e.g., the United States, Italy, Russia, Poland, Uruguay, or Uganda), women comprise more than half of the inward migrant stock. The share of female international high-skilled migration is lower, but increasing due to higher educational attainment for women, increased demand for women's labor in healthcare and service sectors, and changing attitudes toward female migration (Benería et al., 2012; Docquier et al., 2012). However, the share of female migrants in corporate leadership roles is around 13%, and the UN's Migration 2030 Agenda includes specific references to "encourage and enable [migrant] women to accede to areas such as corporate leadership" (Appave and Sinha, 2017, p. 65).

Despite the increasing participation of women in international migration and the policy efforts to increase female participation in corporate roles, little is known about their effects, raising specific economic issues related to the effects of migration (Dumont et al., 2007; Pfeiffer et al., 2007).

In our analysis, we aim to answer two main questions: a) What is the effect of increasing the share of female migrants by job type on market outcomes? b) What is the elasticity of substitution between male and female labor? We focus on a specific outcome: Foreign Direct Investment (FDI). This setting has the advantage of relying on a well-established relationship and a bullet-proof empirical method (structural gravity) to make three novel contributions to the literature: i) introducing an additional channel through which migration enhances FDI, ii) developing a theoretically and empirically sound method to estimate the elasticity of substitution using aggregate data, and iii) providing estimates of the elasticity of substitution between male and female labor for 27 OECD countries and three job types (managers, professionals, and non-qualified).

Comparable cross-country estimates of the elasticity of substitution between female and male labor are relevant for evaluating the effects of policies aimed at increasing female participation in the labor market (De Giorgi et al., 2015). For example, the International Organization for Migration, in the scope of the UN 2030 Agenda, advocates for "migration policies in both countries of origin and destination that are formulated with due regard for the particular needs and experiences of migrant women and girls (...) by organizing programs for the admission of foreign workers specialized in particular fields" (Appave and Sinha, 2017, p. 65). Additionally, we need to consider the costs associated with discrimination. According to Cavalcanti and Tavares (2016), gender discrimination can explain a large fraction of the difference between a country's output and that of the US. Moreover, the (mis)allocation of talent could potentially have important aggregate consequences. Recent research by Hsieh et al. (2019) shows that there could be substantial gains in GDP due to declining occupational barriers that women face. Despite the relevance of these questions, little is known about the potential effect of these policies on aggregate economic outcomes and their effect on incumbent (male) workers in heterogeneous labor markets.

The impact of the feminization of the immigrant labor force depends on whether men and women are "poor" or "good" substitutes. Although it is commonly accepted that female and male labor are imperfect substitutes, there are only a handful of estimates of the elasticity of substitution between female and male labor, in contrast to the ample estimates of the elasticity of substitution between skilled and unskilled labor (Havranek et al., 2020). 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 for many countries. Acemoglu et al. (2004) report an elasticity of substitution between 2 and 5 using US data from the 1940s. Using simulations, Johnson and Keane (2013) estimate an elasticity of 1.85-2.20 for the US during 1968–1996. De Giorgi et al. (2015) estimate an implied elasticity of substitution ranging between 1.0 and 1.4 with more recent Italian data. Nauerz (2022) uses German data and estimates an elasticity of substitution of 0.7. According to Edo and Toubal (2017), if men and women are "poor" substitutes, the rising labor supply of immigrant women relative to immigrant men should affect the gender wage gap. Therefore, the degree of substitutability between men and women is crucial for any study that tries to evaluate the effect of the increasing feminization of the labor force.

We develop a model that adapts labor models with male and female workers (Acemoglu et al., 2004; De Giorgi et al., 2015) to the context of migration and FDI (Cuadros et al., 2019) and includes resource misallocation via gender discrimination (Cavalcanti and Tavares, 2016; Restuccia and Rogerson, 2017). We obtain comparable cross-country estimates from aggregate data in the spirit of Kraay and Van der Weide (2022). 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 using an exogenous shift approach that leverages a relevant feature of structural gravity: domestic flows (Heid et al., 2021; Yotov, 2022). Structural gravity allows us to identify, in addition to bilateral migration flows, the effect of country-specific migration, which enables us to show that the effect of migrants on FDI is labor-related and independent of the information channel Country-specific migrations comprises all migrants living in the host country, which have less information about the country of origin of the investment.

Our results show that overall migration enhances FDI from the migrants' origin to the destination country, which is particularly true for the case of migrants who have a manager or professional job in the destination country. In addition, our estimates suggest that increasing the ratio of female relative to male migrant workers promotes FDI. Nonetheless, this positive effect is significantly lower in countries with high gender discrimination. The estimates reveal that the implied elasticity of substitution is 1.3 on average. However, we might obtain biased estimates of the aggregate elasticity of substitution if the underlying groups are heterogeneous (Miyagiwa and Papageorgiou, 2007). In this line, the elasticity of managers (3.2), professionals (2.1), and non-qualified workers (6.0) reveal that there is an aggregation bias in crude estimates of the elasticity of substitution.

Additionally, the elasticity of substitution between male and female workers is highly heterogeneous in the country sample: it is lower in countries with low gender gaps (e.g., 0.3 in Sweden) than in countries with high gender gaps (e.g., 6.1 in Mexico). For validation, we use this novel estimation procedure to estimate that the implied elasticity of substitution between skilled and unskilled labor is 1.4, which aligns with well-known estimates in the literature (1.5).

An example can help illustrate the central insights of this paper. In September 2018, Uber launched a pilot program that allowed female drivers to choose only female passengers. Careem, a Dubai-based Uber competitor, claimed that "after creating 100,000 jobs for Saudi men, Careem was now looking forward to creating 100,000 more for Saudi women" [1]. Careem's statement implies that the elasticity of substitution between female and male drivers in Saudi Arabia is close to 1. However, this paper's results show that a decrease in female wages associated with an increase of the female ratio of Uber drivers is associated with a decrease of 3.9% in the demand for male taxi drivers (the less productive) and have 0.1% more capital than local taxis. In contrast, increasing by 1% the female ratio in a country with low gender discrimination is associated with a decrease of 1.1% male taxi drivers, with an increase of 0.38% capital relative to local taxis.[2]

The rest of the paper is organized as follows. Section 2 presents the theoretical model that drives the estimation strategy in Section 3. Section 4 presents the empirical results, Section 5 performs robustness checks, and Section 6 concludes.

2 Theoretical model

2.1 Setup

The paper's theoretical framework is based on a standard and simplified version of the gravity equation for foreign capital. In this model, foreign capital is treated as an overhead over domestic capital that depends on the foreign firm's total factor productivity. The productivity of foreign firms is endogenous to the wage ratio between domestic and foreign workers, which is determined by the participation of male and female workers in the labor market. The main contribution of the model is the introduction of male and female workers into the framework, which enables the estimation of the elasticity of

[1] `https://time.com/5320608/saudi-arabia-women-drivers-ban-taxi-driver-uber-careem/`

[2] Elasticities are based on estimates reported in table 7

substitution between them.

The economy is assumed to consist of J countries, with a Cobb-Douglas utility function for a representative consumer in country j given by $U_j = X_{NTj}^{\mu} X_{Tj}^{1-\mu}$. The economy is divided into two sectors: non-traded (NT) and traded (T) goods. The parameter μ represents the share of total spending R_j in each industry, composed of a continuum of differentiated products. The aggregate consumption in the traded sector is the sum of all goods produced. The term X_{Tj} is a standard constant elasticity of substitution (CES) aggregator across the continuum of products (l): $X_j = \left[\int x_j(n)^{\iota} dn\right]^{1/\iota}$, where $\sigma \equiv (1-\iota)^{-1} > 1$ is the elasticity of substitution between any two products. The demand for the variety n is maximized by the following equation:

$$x_j(n) = \frac{p_j^{-\sigma} Y_j}{P_j^{1-\sigma}}, \tag{1}$$

where $Y_j \equiv (1-\mu)R_j$ represents the income of the representative consumer, p_j is the price of the good, P_j is the price index in the traded sector, and R_j is the total spending in each industry, which consists of a continuum of differentiated products.

2.2 Foreign Production

Price-taking firms carry out production in monopolistic competition. To produce the variety n, a firm from the country i in the country j uses two inputs: capital K and labor L_j, which are local workers with j" skills, i.e., the type of skills found in the host country. The foreign firm also requires S_{ij} workers with "ij" skills (i.e., common language) to translate blueprints from country "i". We assume that these workers are not directly involved in producing goods, but they increase total factor productivity. To model production, we use a Cobb-Douglas production function:

$$x_{ij} = S_{ij}^{s}[K_{ij}^{k} L_j^{l}], \tag{2}$$

where the positive constants $s + k + l < 1$ measure the intensity with which the inputs are used in production and are constant. K is capital, S_{ij} are workers with "ij" skills (i.e., common language), and L_j are workers with "j" skills. For domestic firms, do not use "ij" and these first have $s = 0$.

To produce a good, a domestic firm incurs a marginal cost given by the following equation:

$$mc = \alpha(w_{ij}S_{ij} + r_jK_{ij} + w_jL_j), \tag{3}$$

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

Upon entering the market, a foreign firm discovers its total factor productivity, represented by $1/\alpha$. Here, α refers to the number of input units the firm uses to produce one unit of output. It is commonly assumed that the distribution of α across firms follows a continuous Pareto cumulative distribution function (c.d.f) denoted by $G(\alpha)$, with $[\underline{\alpha}, \bar{\alpha}]$ as the range. The density of $G(\alpha)$ is represented by $g(\alpha)$, and the distribution is the same across all countries.

The optimal relative foreign capital needed for production is:

$$K_{ij} = \left(\frac{s/k}{w_{ij}/r_j}\right)^{\frac{s}{1-\eta}} (\alpha/\alpha^*)^{\frac{1}{\eta-1}} (K_j)^{\frac{\eta-1-s}{\eta-1}}, \tag{4}$$

where α^* refers to the productivity threshold required to enter the market, $\eta = l+k+s < 1$, and K_j represents the optimal equilibrium for capital for domestic firms. In the Appendix A, we derive equation (4) and define the domestic capital K_j.

The basic intuition behind equation (4) is that foreign capital can be understood as an overhead over domestic capital. The comparative statics are also in line with economic intuition. Firstly, foreign firms, which are more productive than domestic firms (lower α), are larger in terms of capital. Secondly, foreign capital decreases with increased bilateral "ij"-skilled labor costs.

Obtaining foreign capital in terms of domestic capital is convenient because the core of our empirical strategy will rely on domestic capital. Once we control for domestic capital, equation (4) highlights that only the bilateral component of "ij" labor costs is relevant to explain bilateral foreign investment.[3]

2.3 Multiple firms and FDI gravity equation

The capital investment is the sum invested by the most productive firm $\underline{\alpha}$ to the least productive foreign firm α^*. The equation for this is:

$$\tilde{K}_{ij} = Nj \int_{\underline{\alpha}}^{\alpha} K_{ij}^{FDI} \frac{g(\alpha)}{G(\alpha)} d\alpha = N_j \left(\frac{1}{w_{ij}/r_j \cdot k/s} \right)^{\frac{s}{1-\eta}} \left(K^{Dom} \right)^{\frac{\eta-1-s}{\eta-1}} \int_{\underline{\alpha}}^{\alpha} \left(\frac{\bar{\alpha}}{\alpha} \right)^{\frac{1}{\eta-1}} \frac{g(\alpha)}{G(\alpha)} d\alpha, \tag{5}$$

where N_j 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), which allows us to obtain a log-linear and estimable equation from equation (5). The resulting equation is:

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

where $\lambda_i = \ln N_i$ and $\lambda_j = \ln K_j^{Dom}$ are home and host country fixed effects, respectively. $\bar{w}_{ij} = \left(\frac{r_j/k}{w_{ij}/s} \right)^{\frac{s}{\eta-1}}$, and ω_{ij} is a country-parameter that controls selection and corresponds to the integral of productivity in equation (5).[4]

Equation (6) is effectively a gravity equation for foreign capital. The total foreign capital investment is the result of the home country's fixed effects (the number of firms or the country's economic mass), a host country's fixed effect (minimum capital requirements determined by the host's factor endowments and demand via prices), and a bilateral transaction cost that includes selection into an investment mechanism.

[3]The use of domestic units is crucial for estimation and identification purposes, which are described in Section 3.

[4]We will not estimate directly ω_{ij} as in Helpman et al. (2008), but rather use the non-linear form of the gravity equation as in Santos Silva and Tenreyro (2006).

2.4 Male and female labor

After laying out the bare minimum to model the effect of foreign workers' wages on FDI, we introduce men and women into the model. Consider that "ij"-skilled labor is composed of male (M) and female (F) workers in a standard CES function (Acemoglu et al., 2004; De Giorgi et al., 2015)[5]:

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

where $\rho \leq 1$, the subscripts M are for male and F are for female workers, and $\theta_M + \theta_F = 1$ are gender-dependent productivity parameters, and $\sigma_{MF} \equiv {}^{1}/_{(1-\rho)}$ is the elasticity of substitution between female and male workers. The elasticity of substitution between female and male workers reveals the percentage change in demand for male labor by increasing the relative female wage by 1%.

Associated with the CES labor function in equation (7), the aggregate labor costs that combine male and female labor are now:

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

The FOC (i.e., the marginal product of male and female labor) implies that the female-to-men wage ratio can be expressed (in logs) as[6]:

$$\ln\left(\frac{\bar{w}_{ijF}}{\bar{w}_{ijM}}\right) = -\ln\left(\frac{L_{ijM}}{L_{jM}}\right) + \ln\left(\frac{\theta_F}{\theta_M}\right) - \frac{\theta_F}{\sigma_{MF}} \ln\left(\frac{L_{ijF}}{L_{ijM}}\right). \tag{8}$$

Leaning on the fact that we can express the wage ratio as a labor ratio, $\ln \bar{w}_{ijM} = \ln\left(\frac{1/L_{ijM}}{1/L_{jM}}\right)$, we can write the FDI gravity equation as:

$$\ln FDI_{ij} = \lambda_i + \lambda_j + \omega_{ij} + \ln\left(\frac{L_{ijM}}{L_{jM}}\right) - \ln\left(\frac{\theta_F}{\theta_M}\right) + \frac{\theta_F}{\sigma_{MF}} \ln\left(\frac{L_{ijF}}{L_{ijM}}\right). \tag{9}$$

We have effectively constructed an FDI equation in Equation (9) that allows us to recover

[5]For simplicity, we only consider male and female for foreign labor without loss of generality.

[6]The implicit assumption is that increasing the labor demand decreases wages, as supported by the literature (see, for example, Piyapromdee, 2021). Regarding "ij"-skilled labor, Ottaviano et al. (2018) show that migration reduces production costs by increasing the productivity of exporting firms.

an implied σ_{MF} by estimating foreign labor shares against foreign capital.

2.5 Gender misallocation

A relevant addition to the standard genderization of the labor force is to introduce gender discrimination. We introduce a wedge between women's Marginal Product of Labor (MPL) and their salary as in Cavalcanti and Tavares (2016). The nature of this discrimination is not relevant in this model. Still, the literature usually stems from labor market distortions, flexibility, and technology affecting how relative male and female productivity translates into wages (Goldin, 2014, 2021). For example, in our motivating example, the Saudi cab company would capture part of the female's product of labor to adapt to women's driving regulations (e.g., licenses, fees, uniforms).

Consider that some countries have a distortion in their female wages ($\tau_j > 0$ for some j). In this case, allocation is inefficient, and some countries face higher costs for hiring women. We define Men's MPL as w and Women's MPL as $w(1+\tau_j)$ jointly determining L_M and L_F.

Countries with gender discrimination have inefficiently low L_W and lower wages:

$$MPL_F = (1+\tau_j)w_\tau > w^*,$$

where w^* is the equilibrium labor cost for women in the absence of discrimination ($\tau = 0$) and w_τ is the woman's wage with discrimination. Intuitively, countries with extreme discrimination will pay even lower wages to women with a given level of productivity than men, leading to a lower female labor supply.

Therefore, we can rewrite equation (8) by introducing the wedge on female wages:

$$\ln\left(\frac{\bar{w}ijF}{\bar{w}ijM}\right) = -\ln\left(\frac{L_{ijM}}{L_{jM}}\right) + \ln\left(\frac{\theta F}{\theta M}\right) - \frac{\theta_F}{\sigma}\ln\left(\frac{L_{ijF}}{L_{ijM}}\right) + \ln\tau_j. \tag{10}$$

By introducing (10) into the gravity equation (9), we get:

$$\ln FDI_{ij} = \lambda_i + \lambda_j + \omega_{ij} + \ln\left(\frac{L_{ijM}}{L_{jM}}\right) - \ln\left(\frac{\theta F}{\theta M}\right) + \frac{\theta_F}{\sigma_{MF}}\ln\left(\frac{L_{ijF}}{L_{ijM}}\right) - \ln\tau_j. \tag{11}$$

3 Empirical strategy

The gravity equation in (11) reveals that the effect of increasing female labor participation on FDI is lower in countries with high gender discrimination. Ideally, we would estimate (11) with labor shares of "ij" gendered labor. This data is rarely available and therefore not observed by the econometrician. A good approximation of the "ij" labor ratios would be to use men and woman migration stocks (i.e., individuals from country i that work in country j) [7]. Therefore, we can express the labor ratio as:

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

where ϵ_{ij} is an error term.

Equivalently, we can express the labor shares as

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

Now substituting (12) and (13) in (11), we obtain an empirical equation that we can readily estimate using aggregate migration and FDI data

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

3.1 Structural gravity for migration and FDI

We rely on recent advances in the structural gravity model to estimate the empirical equation (14). The structural gravity model contains several elements that stem directly from theory and deliver consistent estimates. Yotov et al. (2016) outline six basic recommendations: (i) use panel data, (ii) allow for adjustment in trade flows [8], (iii) include intra-national trade flows (Yotov, 2022), (iv) use directional time-varying fixed effects (i.e., origin-time and destination-time fixed effects) (Bergstrand and Egger, 2007), (v)

[7] For a similar approach to estimate an elasticity using aggregate data see Kraay and Van der Weide (2022)

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

employ country-pair fixed effects (not strictly needed from theory, but convenient to control for endogeneity and all time-invariant bilateral trade costs), and (vi) estimate gravity with PPML to avoid heteroskedasticity, include zero trade flows, and ensure that the gravity fixed effects are identical to their corresponding structural terms (Fally, 2015; Santos Silva and Tenreyro, 2006).

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

$$FDI_{ijt} = \exp\left(\begin{array}{c}\left(\begin{array}{c}\beta_1 \underbrace{\ln \text{MigraSk}_{jit-4}}_{\text{Information}} + \beta_2 \underbrace{\ln \text{MigraSk}^{\text{Job}}_{ijt-4M}}_{\text{Network \& labor}} \\ + \beta_3 \underbrace{\ln \psi^{\text{Job}}_{ijt-4}}_{\text{Gender}}\end{array}\right) \times BRDR_{ij} \\ + \lambda_{it} + \lambda_{jt} + \lambda_{ij} + \chi_{ijt} + BRDR_{ij} \times t\end{array}\right) \times e_{ijt}, \quad (15)$$

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) 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.

Equation (15) 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 that take one whenever a pair of countries have signed a Free Trade Agreement (FTA) and a Bilateral Investment Treaty (BIT).

Equation (15) allows us to compute the implied elasticity of substitution with

$$\hat{\sigma}_{MF} = \frac{\theta^F}{\hat{\beta}_3}, \quad (16)$$

where we take the migrant female labor share from our data [9] as values for θ^F.[10]

[9] See these shares in Table 3

[10] Since we assumed that wage and labor/migration ratios where identical the implied elasticity of substitution in equation (16) reveals the percentage change of male demand by increasing the female migration ratio.

The effect of migration is decomposed into three different channels, which are underbraced in Equation (15). Firstly, the information channel is captured by $\ln \text{MigraSk}_{jit-4}$, the log of the share of migrants from country j living in country i. As illustrated in previous literature, migrants provide valuable transnational information that bridges informational frictions between home and host countries. Previous work has emphasized the importance of considering migrant heterogeneity by focusing mainly on the educational attainment of migrants (see Docquier and Lodigiani (2010); Flisi and Murat (2011); Javorcik et al. (2011); Kugler and Rapoport (2007); Tomohara (2017)). Although migrants considered above can transmit information (j $\rightarrow$ i), they cannot reduce labor costs for the affiliate in the host country. Secondly, the second mechanism we account for is the network and labor channels captured by $\ln \text{MigraSk}_{ijt-4M}$, the share of male migrants from country i occupying certain job positions in country j. This variable captures both channels, and we cannot yet separate them. On the one hand, the network channel relies on strong family and cultural ties of migrants with their homeland (see Buch et al. (2006); Burchardi et al. (2019); Cuadros et al. (2019), among others). On the other hand, a large stock of migrant labor might increase productivity and reduce labor costs for foreign affiliates (Ottaviano et al., 2018).

Here again, migrant heterogeneity matters. The network channel seems stronger for educated migrants as this type of migrant brings more information and influence. 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, a common feature of the labor market that seems 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). Cuadros et al. (2019) pioneered the attempt (in a multi-country gravity framework) to account for the controversial evidence referred to 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 positions rather than education as a suitable proxy for the migrants' adequate job skill-sets and decision-making power (Aleksynska and Tritah, 2013; Martín-Montaner et al., 2014)

Thirdly, we account for the gender channel, which could affect the FDI-migration nexus in three ways. First, female and male networks may differ in quality and type of information (Docquier et al., 2012; Ruyssen and Salomone, 2018). The importance of social networks as a mechanism that facilitates migration may differ for men and women because migration's costs, risks, and benefits differ by gender (Curran and Rivero-Fuentes, 2003). Generally, migration is a family-based decision, and people migrate to maximize their income and minimize their migration risks (Gheasi and Nijkamp, 2017). Social networks seem more critical for women, who rely more strongly on relatives and friends for help, information, protection, and guidance at their destination. Second, 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, management, and entrepreneurship are on the opposite flank with highly tacit knowledge with differences in risk aversion and over-confidence, making it a highly masculine profession (Du Rietz and Henrekson, 2000; Goldin, 2021; Huang and Kisgen, 2013). We account for this channel by considering the ratio between female and male migrants from country i occupying certain job positions in country j.

Lastly, an additional 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 will likely 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 significant 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) quantifies the effect of this discrimination on output.

3.2 Migration and FDI: disentangling labor and network channels

Previous literature has not yet disentangled labor and the network channels, which is relevant to confirm the theoretical results of this paper. An essential assumption to estimate an implied elasticity of substitution is that migration affects FDI through wages. We demonstrate an information-independent effect of migration by estimating the impact of all other migrants employed in the host country, except those from the affiliate's home country. The positive effect of this group, 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.

One important advantage of using intra-national flow data is that it allows identify the effects of country-specific variables at the same time that we include origin-time and destination-time fixed effects. As demonstrated by Beverelli et al. (2023); Heid et al. (2021), this is achieved by interacting the country-specific variables with a border dummy ($BRDR_{ij}$). Otherwise, the abovementioned fixed effects would be collinear with the country-specific variables. This allows us to identify the effect of all other migrants, who do not have strong information signaling, on FDI relative to domestic investment.

In particular, we estimate the following equation:

$$FDI_{ijt} = \exp\left(\begin{pmatrix} \beta_1 \underbrace{\ln \text{MigraSk}_{jit-4}}_{\text{information}} + \beta_2 \underbrace{\ln \text{MigraSk}^{\text{Job}}_{ijt-4M}}_{\text{Network \&labor}} \\ \beta_3 \underbrace{\ln \text{MigraSk}^{\text{Job}}_{j\neq it-4M}}_{\text{labor}} + \beta_4 \underbrace{\ln \psi^{\text{Job}}_{i\neq jt-4}}_{\text{gender}} \end{pmatrix} \times BRDR_{ij} \atop + \lambda_{it} + \lambda_{jt} + \lambda_{ij} + \chi_{ijt} \right) \times e_{ijt}, \quad (17)$$

where $\ln \text{MigraSk}^{\text{Job}}_{j\neq it-4M} = \ln\left(\sum_i \text{MigraSk}^{\text{Job}}_{it-4M} - \text{MigraSk}^{\text{Job}}_{ijt-4M}\right)$ is the sum of all migrants from the rest of the countries excluding country i. The same calculation is used to obtain $\ln \psi^{\text{Job}}_{i\neq jt-4}$. These variables capture the labor channel exclusively because these migrants have no "ij"-skills.

Estimating (17) is interesting from at least three perspectives. Firstly, it represents a novel attempt to estimate 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's ability to transmit information depends highly on their translational skills and characteristics. However, models that rely on labor channels view migration as a valuable labor resource. Migrants from diverse origins could also have similar effects on reducing labor costs without the information signaling. Thirdly, it allows us to identify better the effect of migration, as we discuss below.

3.3 Endogeneity

Several biases might affect our empirical strategy. Firstly, as highlighted by Miyagiwa and Papageorgiou (2007), the aggregate estimates of the implied elasticity of substitution delivered by equation (15) underestimate the value of σ_{MF} due to an over-aggregation bias. To tackle this issue, we estimate three separate equations for each job category: Manager, Professional, and Non-qual.

Secondly, we face the issue of reverse causality, where migrants tend to be located in countries following FDI. To tackle this issue, we employ several strategies to mitigate this source of endogeneity: (i) Including the international border dummy aids our identification strategy by providing an exogenous shift to the migration. The interacted coefficients capture the effect of migration on FDI relative to domestic investment. If some of the migration occurs by "following" FDI, we would be isolating that effect as long domestic migration also "follows" domestic investment (because now that becomes the reference group). A formal proof of the interaction between exogenous variables with potential endogenous regressors can be found in Nizalova and Murtazashvili (2016). (ii) The border dummy allows us to identify country-specific migration. By excluding migrants from the same origin as the FDI in (17), we are greatly reducing the occurrence to reverse causality in our setting. (iii) The migration variables are lagged to reduce the potential harmful simultaneity between FDI and migration (Bratti et al., 2014; Cuadros et al., 2019; Peri and Requena-Silvente, 2010). (iv) Specifying the left-hand-side variable as flows and the right-hand-side variables as stocks, further reduced the potential adverse effects of simultaneity (Gil-Pareja et al., 2022).

Thirdly, the standard approach in the gravity literature since Baier and Bergstrand (2007) of including a full set of country-pair, origin-year, and destination-year fixed effects reduces the incidence of omitted variable bias, as we are controlling for unobserved constant heterogeneity at the country-pair level and time-varying heterogeneity at the country level.

3.4 Data description and sources

The present study uses FDIMarkets greenfield investment data from 2003-2016 to estimate the count of foreign projects. For domestic investment, we use the number of firms created during a year from the World Bank's Ease of Doing Business report[11]. We retrieved data on bilateral migration stocks by sex and job skills for 2001, 2005, and 2011 from the OECD's Database on Immigrants in OECD Countries (DIOC). To overcome

[11]The number of firms created during a year is a statistic that starts in 2006, which we used to input the extensive margin's domestic investment in 2004 and 2005. This data imputation does not affect our results.

the limitation of migrant data availability, we interpolate the missing years.[12] These data limit the country sample to the 27 countries reported in Table 2, for which we have detailed asymmetric migration flows by profession. To keep the United States in the sample, we group migrants' job occupations into three categories: managers, professionals, and non-qualified (see Table ??), following Cuadros et al. (2019).

Table 1: 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

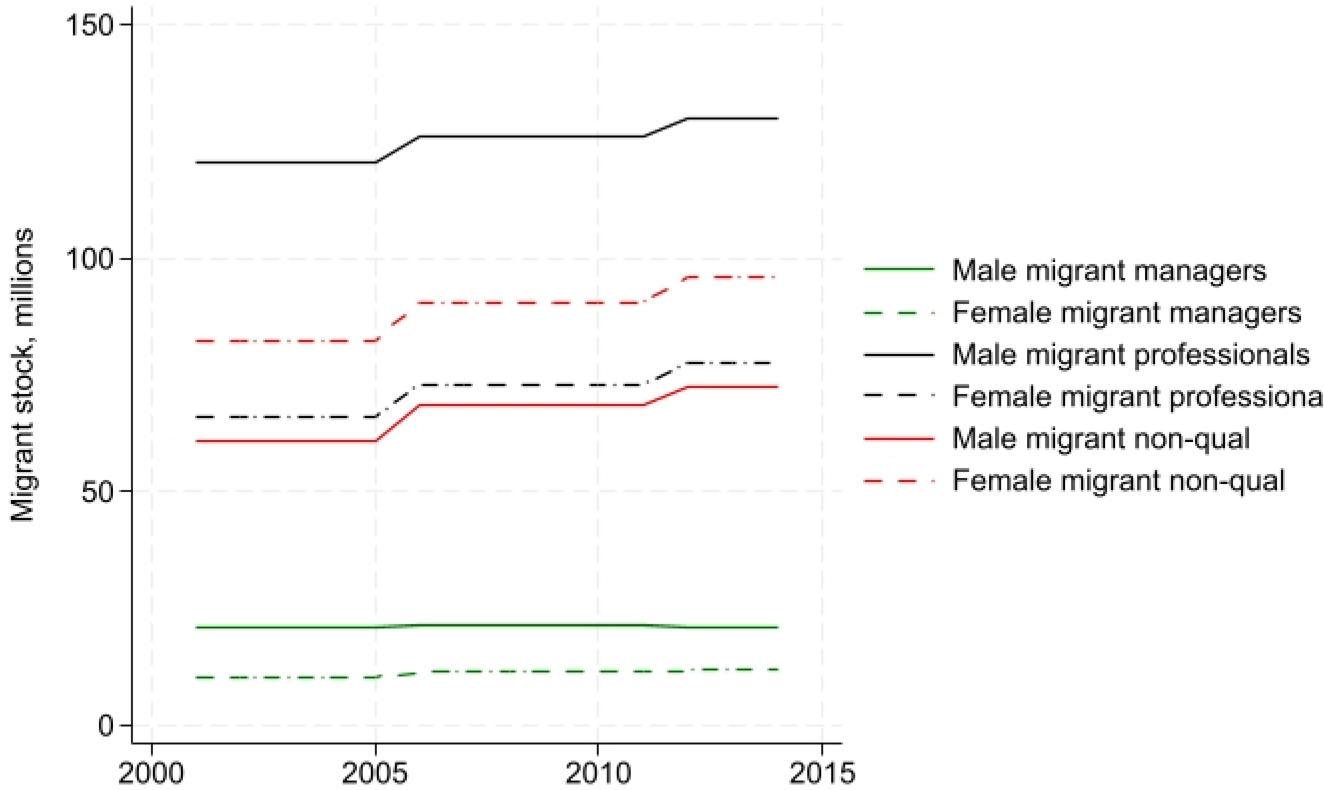
Note: Jobs skills groups classification as in Cuadros et al. (2019).

The gender differences in jobs among employed migrants in OECD countries are substantial. Figure 1 illustrates the evolution of migrant stocks by occupation. Male professionals are the more numerous group in our sample. Female professionals and female managers' stocks are lower than their counterparts males. Non-qualified female migrants are higher than non-qualified male migrants.

Table 2 shows that in all countries with available data, at least 70% of migrant managers are male, while women mostly dominate non-qualified jobs. These data provide cross-sectional and time variation in our variables of interest, enabling panel estimation.

[12]We have tested several specifications without significantly affecting the estimates.

Figure 1: Gender differences in migrants stocks by occupation



Note: Authors' own elaboration based on OECD migration stock by occupation.

Table 3: Job and gender shares by domestic and migration labor

	Migra	Dom	F Dom	F Migra θ^F
Total			0.451	0.451
Managers	0.121	0.084	0.326	0.348
Professionals	0.515	0.553	0.358	0.398
Non-qualified	0.357	0.363	0.624	0.577

Note: Authors' own calculations based on OECD statistics. Columns (1) and (2) respectively refer to the share of each profession over total international and domestic migration. Columns (3) and (4) respectively refer to the bilateral average of the female-male ratio for domestic and international migration.

Table 2: Average share of female inward migrants stock by profession

	Manager	Professional	Non-qualified
AUS	0.356	0.379	0.625
AUT	0.261	0.336	0.654
BEL	0.311	0.325	0.595
CAN	0.381	0.408	0.608
CHE	0.233	0.319	0.677
CHL	0.470	0.272	0.535
CZE	0.332	0.396	0.652
DEU	0.276	0.354	0.662
DNK	0.268	0.427	0.625
ESP	0.304	0.317	0.582
FIN	0.296	0.388	0.733
FRA	0.371	0.342	0.712
GBR	0.354	0.333	0.664
GRC	0.296	0.345	0.516

	Manager	Professional	Non-qualified
HUN	0.369	0.407	0.599
IRL	0.409	0.326	0.646
ITA	0.257	0.331	0.544
LUX	0.302	0.338	0.608
MEX	0.333	0.221	0.482
NLD	0.271	0.375	0.639
NOR	0.261	0.341	0.728
NZL	0.366	0.387	0.616
POL	0.415	0.388	0.640
PRT	0.328	0.352	0.632
SVK	0.375	0.413	0.635
SWE	0.305	0.377	0.717
USA	0.377	0.442	0.519

The migrant female labor shares are reported in Table 3. The parameter θ^F to calculate σ_{FM} is shown in the last column. The shares are very similar for domestic and migrant labor. Therefore, we believe that an approximation of using migrant labor shares in the regression was a valid one.

The FTA control variables are retrieved from the World Bank (Hofmann et al., 2017), while the BIT control variables are obtained from the UNCTAD investment monitor.

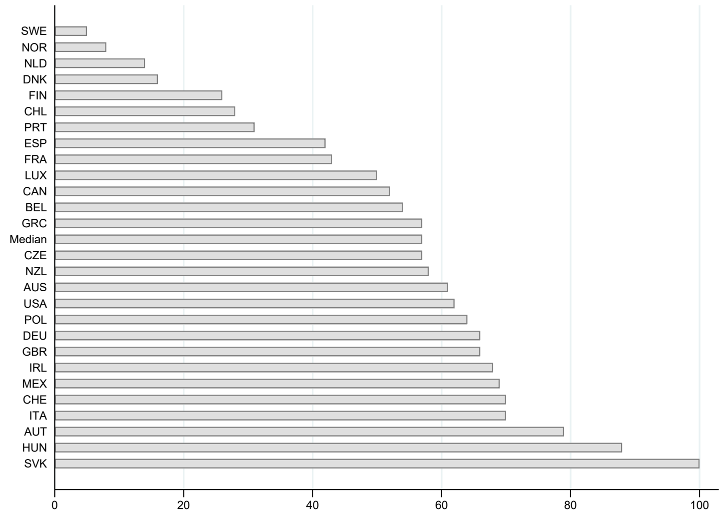
Measuring gender discrimination is challenging and still open to debate (e.g. Barns and Preston, 2010; Dijkstra and Hanmer, 2000; Permanyer, 2010, 2013), but it is essential for empirically testing the implications of the proposed theoretical model in Section 2.1. Therefore, this study relies on two different indicators: Hofstede's Masculinity index (MAS) (Hosftede, 1980) and the Gender Inequality Index (GII) from the United Nations Development Programme (UNDP, 2010) in the year 2005. Besides their different approaches to measuring gender inequality, which confers robustness to our empirical analysis, these indicators have been widely used in previous literature examining the implications of gender inequality (e.g. Audette et al., 2019; Hahn and Bunyaratavej, 2010; Pickbourn and Ndikumana, 2016).

The MAS index attempts to gauge if values usually related to men or women are predominant in society by measuring masculinity versus femininity. 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"[13]. The GII measures the differences between men and women regarding 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 for the MAS and GII indexes, respectively. As can be observed, the group of countries above the indexes' median varies; thus, in the empirical analysis, the list of countries considered as having high gender inequality is not entirely homogeneous. Nevertheless, the majority of countries that are above the median for the case of the MAS are also above the median for the GII index. The present analysis focuses on a country sample whose gender inequality is relatively low compared to the rest of the world. Countries that occupy the top places in terms of gender inequality are not included in our analysis. We base our baseline analysis on the MAS since this index seeks to approximate the extent to which gender roles are distinct.

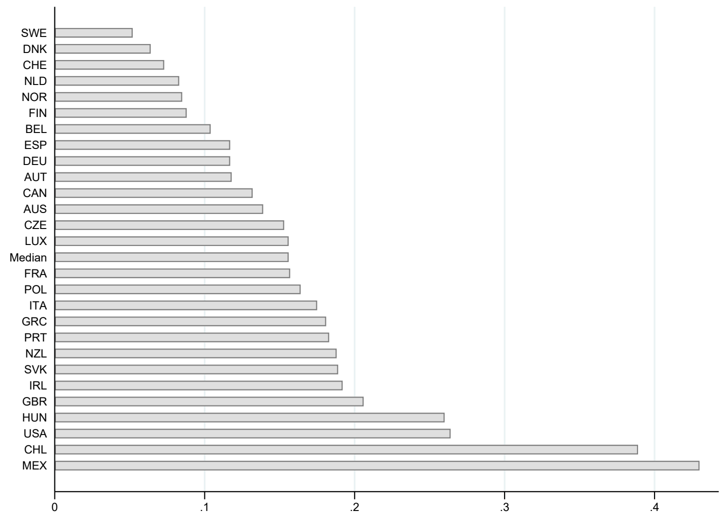
[13]Definition retrieved from Hofstede Insights: `https://hi.hofstede-insights.com/`

Figure 2: Hofstede's masculinity-femininity index



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

Figure 3: United Nations Development Programme Gender Inequality Index (GII) in 2005



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

4 Results

4.1 Baseline

Our estimates begin by reporting in Table 4 the effect of estimating the effect of men and women migrants on FDI. The control variables (BIT and FTA) are not significant in this sample of countries, which is not an uncommon result in this literature (Egger et al., 2023). The border effect, which measures the difference between domestic and international investment, reduces its negative effect over time[14]. Additionally, we find no evidence supporting that the information channel (i.e., migrants living in country i) is relevant for explaining bilateral greenfield investment projects relative to domestic investment. Independently of the level of job qualification, migrants do not seem to enhance investment from their new home country into the country in which they are originally from.

Regarding our variables of interest (men and women migrants), we observe that the total number of men and women migrants have no significant effect on FDI. Men and women managers have the same null effect on FDI. It is only on professionals and non-qualified migrants where we observe a positive effect of increasing female migration, as this variable is on the only that has a positive and significant effect on FDI. Note that these coefficients are interacted with the international border dummy. Therefore, the effect of professional and non-qualified migrant women is positive on international investment relative to domestic investment. Another way to interpret this result is that the migrant women decreases the negative effect of border (i.e., becomes less negative), and therefore foster FDI.

These initial estimates are interesting because they show the role of the border estimates and how to interpret the coefficient estimates. They also hint at the effect of increasing the female-to-male ratio (since we are controlling for the stock of male migrants, increasing female migration is *de facto* increasing the female-to-male ratio).

[14]The border effect is negative, but is not reported in Table 4 because it is absorbed by the pair fixed effects. The positive and increasing signs of the interaction between the BRDR dummy and the year indicate that the border becomes less negative over time

However, these results also highlight the limitations of this approach to studying the effect of gendered migration. Firstly, we cannot directly compute the EoS from the coefficient estimates. Secondly, the colinearity between migrant male and female migration stock, prevents obtaining precise estimates. In what follows, we recur to the specification presented in equation (15), which includes male migration stock and the female-to-male ratio.

Several interesting findings emerge from the baseline results after estimating equation (15), as reported in Table 5. As expected, the coefficients of our variables of interest are estimated with higher precisions than in Table 4, since they are less colinear. The results suggest that increasing ij male migrants promotes FDI, relative to domestic investment. This is particularly true for the case of migrants who are managers and professionals. One percent increase in ij male manager migrant manager stock is associated with a 0.168% increase in the number of greenfield investment projects relative to domestic investment. In the case of professionals, this positive effect is 0.147%, while in the case of ij migrants that occupy non-qualified jobs, the coefficient is not significant. The effect of increasing the female-male ratio is positive and significant in all cases. Overall, increasing the share ratio of female migration is associated with an increase of 0.335% of FDI flows. Also, as it can be gathered in columns (2) to (4), the positive effect of increasing this ratio is slightly larger for skilled labor. Increasing the ratio of female managers by 1%, professionals, and non-qualified labor is associated with an increase of 0.109%, 0.186%, and 0.096%, respectively. Thus, these estimates indicate that, *ceteris paribus*, the positive effect on FDI of increasing the stock female of ij migrants is larger than in male ij migrants. [15]

To gain intuition on the interpretation of the results, Figure 4 shows the yearly evolution of the average marginal effect of the reduction of the border and the contribution of the female-male ratio. The figures highlight the reduction in the border effect between 1 and 2 points (gravity estimates of the border effect for greenfield FDI suggest a border

[15] Indeed, *ceteris paribus*, increasing the share of ij male migrants over total male migrants keeping the ratio ($\ln\left(\frac{\text{Migra}_{ijF}}{\text{Migra}_{ijM}}\right)$) constant, implies also a growth of ij female migrants over total female migrants.

Table 4: Men and women bilateral migrants

	(1) Total	(2) Managers	(3) Professional	(4) Non-qual
BIT	-0.512	-0.572	-0.641	-0.597
	(0.62)	(0.63)	(0.68)	(0.61)
FTA	0.056	-0.020	-0.043	-0.049
	(0.12)	(0.11)	(0.10)	(0.10)
$\ln \text{MigraSk}_{jit-4} \times BRDR_{ij}$	0.001	0.050	0.029	0.049
	(0.06)	(0.04)	(0.04)	(0.05)
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$	0.072			
	(0.13)			
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4F} \times BRDR_{ij}$	0.166			
	(0.11)			
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$		0.047		
		(0.05)		
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4F} \times BRDR_{ij}$		0.030		
		(0.05)		
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$			-0.020	
			(0.06)	
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4F} \times BRDR_{ij}$			0.188***	
			(0.06)	
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$				-0.064
				(0.05)
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4F} \times BRDR_{ij}$				0.116**
				(0.05)
$BRDR_{ij} \times YEAR_{2004}$	0.080	0.063	0.064	0.070
	(0.07)	(0.06)	(0.06)	(0.06)
$BRDR_{ij} \times YEAR_{2005}$	0.181**	0.232***	0.229***	0.236***
	(0.07)	(0.06)	(0.06)	(0.06)
$BRDR_{ij} \times YEAR_{2006}$	0.273***	0.354***	0.357***	0.357***
	(0.06)	(0.06)	(0.06)	(0.06)
$BRDR_{ij} \times YEAR_{2007}$	0.411***	0.467***	0.472***	0.471***
	(0.07)	(0.06)	(0.06)	(0.06)
$BRDR_{ij} \times YEAR_{2008}$	0.549***	0.606***	0.593***	0.614***
	(0.07)	(0.06)	(0.06)	(0.06)
$BRDR_{ij} \times YEAR_{2009}$	0.510***	0.534***	0.523***	0.541***
	(0.06)	(0.06)	(0.05)	(0.05)
$BRDR_{ij} \times YEAR_{2010}$	0.442***	0.466***	0.456***	0.476***
	(0.06)	(0.06)	(0.05)	(0.05)
$BRDR_{ij} \times YEAR_{2011}$	0.385***	0.416***	0.409***	0.426***
	(0.06)	(0.05)	(0.05)	(0.05)
$BRDR_{ij} \times YEAR_{2012}$	0.372***	0.403***	0.396***	0.415***
	(0.06)	(0.06)	(0.06)	(0.06)
$BRDR_{ij} \times YEAR_{2013}$	0.342***	0.394***	0.386***	0.406***
	(0.06)	(0.05)	(0.05)	(0.05)
$BRDR_{ij} \times YEAR_{2014}$	0.331***	0.385***	0.365***	0.395***
	(0.07)	(0.05)	(0.06)	(0.05)
$BRDR_{ij} \times YEAR_{2015}$	0.294***	0.373***	0.355***	0.383***
	(0.06)	(0.05)	(0.06)	(0.05)
$BRDR_{ij} \times YEAR_{2016}$	0.251***	0.310***	0.292***	0.323***
	(0.07)	(0.05)	(0.06)	(0.05)
Observations	3259	6566	6902	6650
OriginxYearFE	Yes	Yes	Yes	Yes
DestinationxYearFE	Yes	Yes	Yes	Yes
PairFE	Yes	Yes	Yes	Yes

Note: PPML. Robust standard errors in (), clustered by country pair. 2003 base year
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Bilateral migration by occupation and gender × BRDR

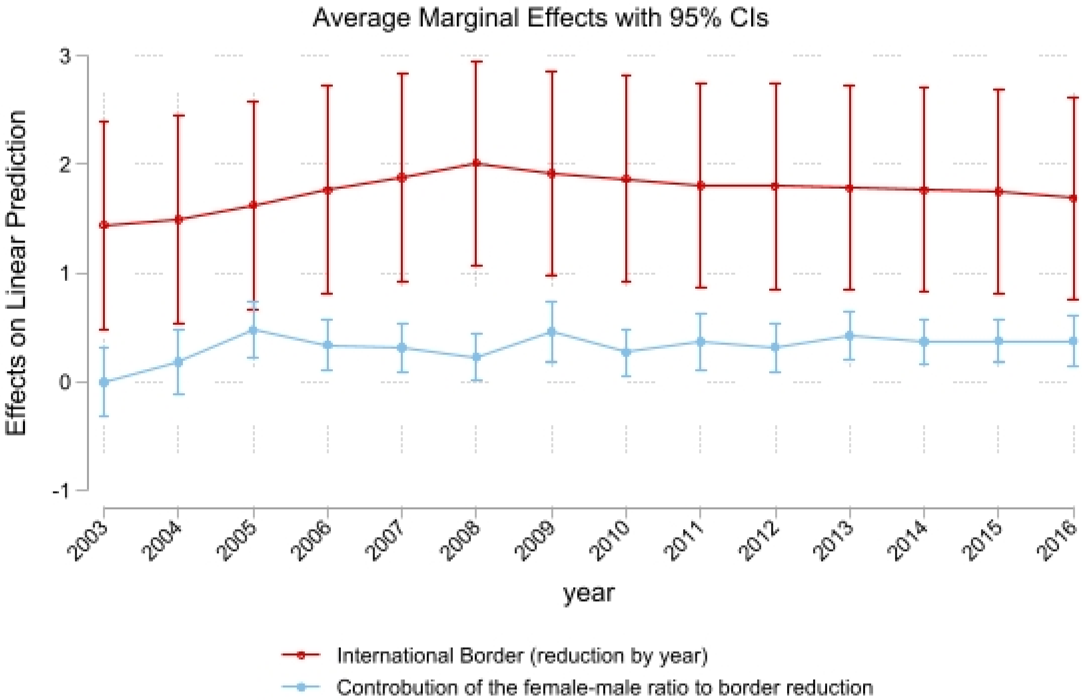
	(1) Total	(2) Manager	(3) Professional	(4) Non-qual
$\hat{\sigma}_{MF}$	1.3	3.2	2.1	6.0
$\ln \text{MigraSk}_{jit-4} \times BRDR_{ij}$	0.035	0.034	0.050	0.072
	(0.05)	(0.04)	(0.05)	(0.05)
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$	0.225***	0.168***	0.147***	0.037
	(0.06)	(0.04)	(0.05)	(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

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

effect coefficient of around -4). The literature explains the reduction in the border effect as an artifact of unexplained globalization forces like capital and labor markets integration. Our results show that around 10% of the reduction in the border effect is accounted by increasing female migration flows.

Figure 4 allows us to better understand the exogenous shift approach. Assuming that the border dummy is exogenous (because international investment decision is independent of the volume of the investment), our estimates are capturing the contribution of the variable of interest (the female-male migrant ratio), to that exogenous border dummy, or more precisely, to the reduction of the border effect.

Figure 4: Border effect reduction and female-male migrant ratio's contribution



Note: Yearly estimate from the model estimated in Table 5 border effect and female-male ratio.

4.2 Elasticity of substitution between male and female labor

Relying on equation (16), estimates from Table 5 ($\ln \psi_{ijt}^{Job}$) and female migrant shares from Table 3, we calculate the elasticity of substitution between male and female migrant labor ($\hat{\sigma}_{MF}$ reported in Table 5). For instance, the overall elasticity of substitution between male and female migrant labor is the result of $\hat{\sigma}_{MF} = 0.451/0.335$. In this regard, it is relevant to stress that estimates reported in Table 5 are interacted with the international border dummy. Therefore, the coefficients' interpretation is relative to the base category, i.e., domestic investment.

As it is reported in Table 5, the implied elasticity of substitution between male and female labor ($\hat{\sigma}_{MF}$) is greater than one, suggesting that men and women migrants are imperfect substitutes. The aggregate elasticity of substitution is 1.3, meaning that increasing male wages by 1%, which in our model is equivalent to a decrease in the relative cost of employing females, increases by 1.3% the female labor demand. The calculated values of $\hat{\sigma}_{MF}$ are larger for individual occupations, which is expected and in line with the aggregation bias discussed by Miyagiwa and Papageorgiou (2007).

Notably, the elasticity of substitution is lowest for professionals (2.1) and highest for non-qualified workers. This means that non-qualified men and women are highly interchangeable in the workforce. Professionals' occupations are less interchangeable, suggesting that there may still be some over-aggregation bias for professionals. For example, it might be a challenge to substitute a male IT technician for a female fishery worker. The elasticity of substitution for managers is 3.2, suggesting relatively high interchangeability.

By estimating the effect of migration on FDI in countries individually, we are able to calculate the specific elasticity of substitution (for the aggregate number of migrants) by country. These are reported in Table 6. As it can be gathered, Mexico with 6.1 has the highest elasticity of substitution in our sample. Increasing by 1% the female labor ratio is associated with a decrease of 6.1% in male labor. Luxembourg has the lowest elasticity of substitution: 0.1. This means that increasing the female ratio practically does not affect male labor.

Our results fall in the range of the few contemporary elasticities of substitution reported in the literature. Our estimate for Italy (1.0) is in the range of the one reported by De Giorgi et al. (2015) for Italian labor: between 1.0 and 1.5. Germany (1.2) is higher than Nauerz's (2022) estimate of 0.7.

Table 6: Elasticities of substitution (EoS) by country

Country	iso3-code	EoS	Country	iso3-code	EoS
Australia	AUS	0.2	Ireland	IRL	0.4
Austria	AUT	0.7	Italy	ITA	1.0
Belgium	BEL	0.8	Luxembourg	LUX	0.1
Canada	CAN	1.0	Mexico	MEX	6.1
Chile	CHL	2.3	Netherlanders	NLD	1.4
Czech Republic	CZE	1.0	Norway	NOR	1.4
Denmark	DNK	0.5	New Zeland	NZL	0.5
Finland	FIN	1.0	Poland	POL	1.3
France	FRA	1.0	Portugal	PRT	0.7
Greece	GRC	5.3	Switzerland	CHE	0.4
Great Britain	GBR	2.7	Slovakia	SVK	2.9
Germany	DEU	1.2	Spain	ESP	0.3
Hungary	HUN	0.7	Sweden	SWE	0.3
			United States	USA	0.8

Note: Authors' own calculations of country level EoS.

4.3 Elasticity of substitution between male and female labor and gender discrimination

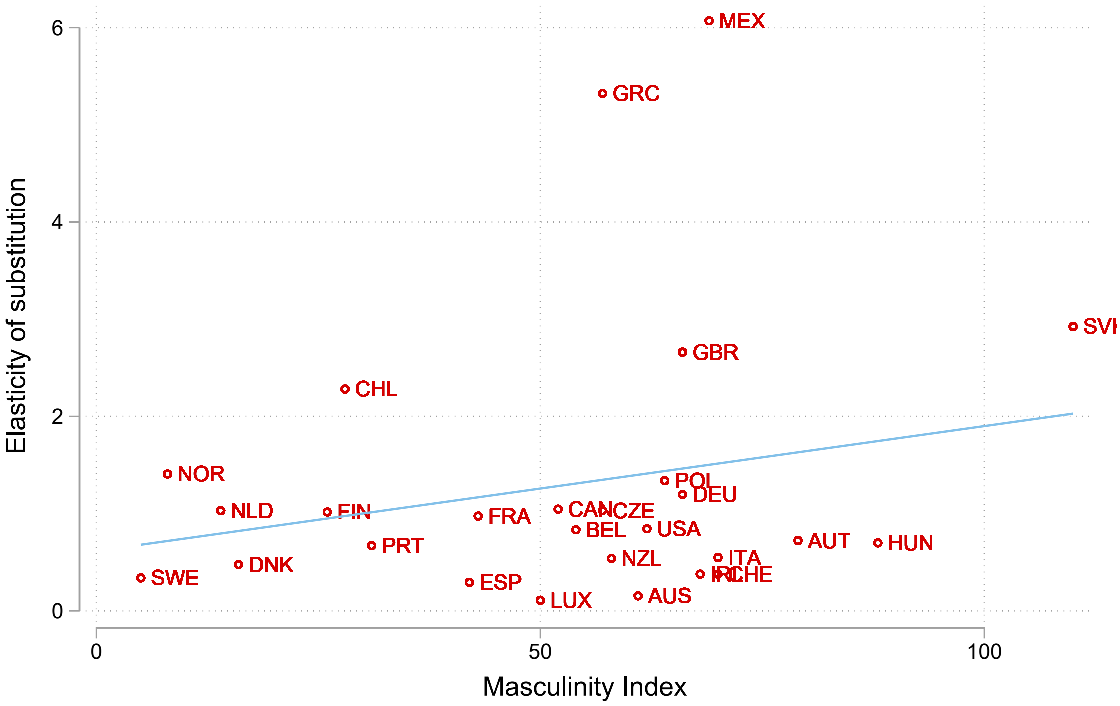
Figure 5 exhibits the positive correlation between the EoS and the discrimination with the MAS index. As it can be gathered, this correlation suggests that countries with higher Eos tend to have a higher discrimination against women (a higher MAS index). In the following lines, we test whether EoS is larger in countries with higher gender discrimination. To this end, we create an indicator variable that takes the value one if the destination country has MAS index higher than our sample median (see Figure 2) and we interact it with the female-male ratio ($\ln \psi_{ijt}^{Job}$). We include this interaction in our empirical equation (15). Results are reported in Table 7.

In line with the intuition presented in Figure 5, estimates show that the positive effect of increasing the female-male ratio is statistically lower in countries that are classified as having higher gender discrimination. Thus, in countries with high discrimination, increasing the female-male ratio promotes FDI relative to domestic investment, but to a lower extent than in countries with lower discrimination. Besides, these results also illustrate that gender discrimination imposes a significant and substantial bias on the estimated values of $\hat{\sigma}_{MF}$.

The $\hat{\sigma}_{MF}$ value is consistently lower in countries with a low masculinity index than in those with a high masculinity index. While the aggregate estimate of $\hat{\sigma}_{MF} = 0.7$ might lead us to conclude that male and female labor are complementary in countries with low gender gaps, this conclusion is driven by an aggregation bias. In fact, the estimates for each occupation reveal that $\hat{\sigma}_{MF} > 1$ in all cases, although managers and professionals are nearly perfect substitutes in this instance. Therefore, gender equality in these countries would be nearly Pareto efficient from the perspective of incumbent men, implying that policies aimed at increasing female participation in the labor force would also benefit male labor. However, even the low-significant results for managers and non-qual might not be conclusive evidence of no discrimination because discriminated groups sort on their ability to overcome non-market barriers (Hsieh et al., 2019).

Alternatively, in countries with higher masculinity index, the EoS is large, above 3 in each type of profession. In these countries, for instance, decreasing by 1% female manager wage would lead to a reduction of 3.8% male manager migrants. In these countries, policies aiming to increase female participation are prone to negatively affect male's employment. This is to be expected, as it implies a substitution of less productive workers by more productive ones.

Figure 5: EoS vs Gender discrimination index, MAS



Note: Authors' own elaboration based on countries' EoS and MAS index.

Table 7: 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
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$	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

Note: PPML, Robust s.e. in (), clustered by CP. Controls: BIT, FTA, BRDBxYear $\ln \text{Migra}_{jit-4}$
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.4 Validity: labor channel with country-specific migration

In the next set of tables within this subsection, we aim to provide validity to our estimates by presenting evidence of the underlying mechanisms and further implied estimates of $\hat{\sigma}_{MF}$. Table 8 is, to our knowledge, the first to report results on the effect of country-specific migration by estimating a gravity equation with a complete set of fixed effects. The results in Panel (a) suggest that the share of the total migration stock in a country is significantly and positively associated with FDI flows. Confirming previous results in the literature, managers have the largest effect on FDI, and non-qualified have the lowest. We decompose the effect into bilateral migration shares and the aggregate shares from all other origins as specified in equation (17). Both are positive and significant. However, the effect of migrants from all other origins is larger. Furthermore, the results in Table 8 Panel (a) reveal that the "ij" skills that are associated with higher levels of FDI are those of managers. A high-skilled labor force with bilateral "ij" skills (managers and to a fewer extent professionals) commands a premium. As highlighted in column 2 of Panel

(b) in Table 8, managers from all other origins show the largest effect. However, professionals and non-qual have a positive and sizeable effect. Notably, while non-qualified "ij" migration have no significant effect on FDI, having a large pool of "j" migrant labor force positively and significantly impacts FDI. Overall, these results suggest the relevance of the labor channel in the migration-FDI link, which was key to our theoretical model.

Table 8: Country-specific migration by occupation

	(1)	(2)	(3)	(4)
	Total	Manager	Professional	Non-qual
Panel (a)				
$\ln \text{MigraSk}^{\text{Job}}_{jt-4} \times BRDR_{ij}$	0.485***	0.529***	0.522***	0.391***
	(0.06)	(0.09)	(0.06)	(0.05)
Panel (b)				
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4} \times BRDR_{ij}$	0.140**	0.161***	0.093*	0.030
	(0.06)	(0.05)	(0.05)	(0.05)
$\ln \text{MigraSk}^{\text{Job}}_{j \neq it-4} \times BRDR_{ij}$	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

Note: PPML, Robust s.e. in (), clustured by CP. Controls: BIT, FTA, BRDBxYear $\ln \text{Migra}_{jit-4M}$
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Panel (a) and Panel (b) are two independent regressions.

To validate our previous results, we estimated the implied $\hat{\sigma}_{MF}$ for "j" migrants (excluding "ij" migrants), and we report the results in Table 9. The results suggest certain complementary between men and women in the labor force. However, the values are relatively close to one another and below one, suggesting that male and female labor are almost perfect substitutes on aggregate terms. We cannot reject the hypothesis that these values are statistically different from one. These results reduce the endogeneity bias induced by reverse causality (because we exclude "ij" migrants). As in the previous table, we can better isolate the labor channel from other networking effects that do not operate through wages. We should, however, interpret the results with caution because, in this case, we allow for the substitution of male and female labor from multiple origins, which induces some aggregation bias.

Table 9: 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
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4} \times BRDR_{ij}$	0.127*	0.151***	0.310***	0.018
	(0.06)	(0.04)	(0.12)	(0.05)
$\ln \text{MigraSk}^{\text{Job}}_{i \neq jt-4M} \times BRDR_{ij}$	0.284***	0.139	0.094*	0.275***
	(0.07)	(0.11)	(0.05)	(0.05)
$\ln \psi^{\text{Job}}_{i \neq jt} \times BRDR_{ij}$	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

Note: PPML, Robust s.e. in (), clustured by CP. Controls: BIT, FTA, BRDBxYear $\ln \text{Migra}_{jit-4}$
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Finally, we highlight our main results in Table 10 which summarizes the estimates of $\hat{\sigma}_{MF}$ presented in Tables 5, 7 and 9.

Table 10: 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***

5 Robustness

We conclude our empirical analysis by performing robustness checks and further validity tests. Table 11 presents two different analyses. Firstly, we consider the scenario where gender equality policies aim to shift the composition of migrant shares. For instance, policies that increase the proportion of female manager visas at the expense of other types. To accomplish this, we introduce the stock of migrants, the share of managers, and the female-to-male ratio. The results reveal that the effect and the implied elasticity of substitution are quite similar to our baseline specification reported in Table 5. In column (2) we replicate the analysis for the case of professionals.

Table 11: 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
$\ln \text{MigraSk}_{ijt-4M} \times BRDR_{ij}$	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

Note: 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 empirical exercise reported in Column 3 of Table 11 are important for validating our approach. It is well-established that the elasticity of substitution between skilled and non-skilled labor typically falls between 1.3 and 2.5, with a consensus estimate of 1.5 (Cantore et al., 2017, p. 80). When we apply our method to estimate the substitution between skilled labor (managers and professionals) and non-skilled labor (non-qualified), we obtain a value of 1.4.

The estimates presented in Table 12 replicate the same exercise as in Table 5, but each variable is not interacted with the international border dummy. The shift treatment inflates the female-to-male ratio estimates, thereby reducing the implied $\hat{\sigma}_{MF}$. The estimate of the effect of non-qualified migrant shares is imprecise, and we obtain a much larger estimate of $\hat{\sigma}_{MF}$ (6.0) than in Table 5 with the exogenous shift. Overall, these results tend to confirm that the use of the border variable was appropriate.

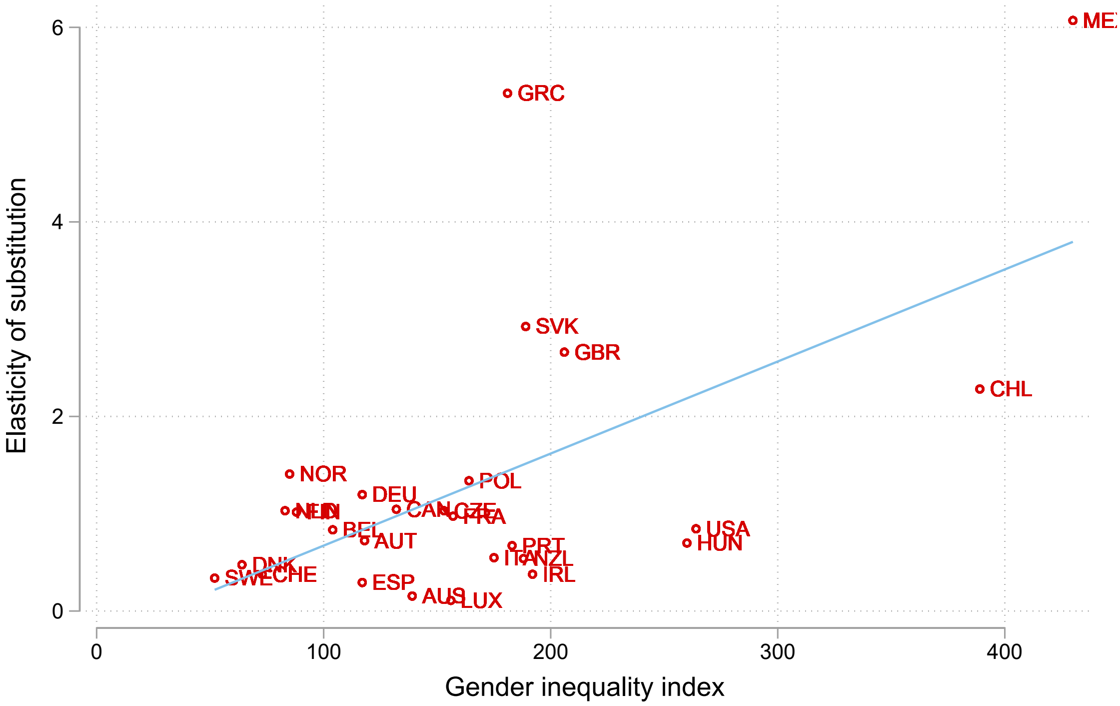
Table 12: Bilateral migration by occupation and gender

	(1) Total	(2) Manager	(3) Professional	(4) Non-qual
$\hat{\sigma}_{MF}$	2.3	3.2	3.0	18.6
$\ln \text{MigraSk}_{jit-4}$	0.024	0.024	0.043	0.067
	(0.05)	(0.04)	(0.05)	(0.05)
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4M}$	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

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

We employ the GII index instead of the MAS index as an additional robustness check. A scatter plot of the correlation is shown in Figure 6. The results from Table 13 using the GII index are qualitatively comparable to those from Table 7 using the MAS index, but with some quantitative disparities.

Figure 6: EoS vs Gender discrimination, GII



Note: Authors' own elaboration based on countries' EoS and the GII index.

Table 13: 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
$\ln \text{MigraSk}^{\text{Job}}_{ijt-4M} \times BRDR_{ij}$	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

Note: PPML, Robust s.e. in (), clustered by CP. Controls: BIT, FTA, BRDBxYear $\ln \text{Migra}_{jit-4}$
$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

6 Conclusions

This paper offered several contributions to the literature. First, it examines the effect of increasing female ratios of migrant flows on FDI. Second, it presents evidence supporting an information-independent, labor-related channel that explains the impact of migration and FDI. Third, the paper develops a method for estimating the elasticity of substitution between male and female labor using FDI and migration data. An advantage of this approach is that wage data is not required to estimate the elasticity of substitution. The estimates rely on the structural gravity equation, which addresses most of the known empirical biases.

We believe that the comparable cross-country estimates are useful for two purposes. On the one hand, they can be used for calibrating models that incorporate these heterogeneous agents. On the other hand, they allow us to compare gender discrimination across countries and gauge the effects on incumbent men of increasing female labor participation, which has significant implications for policymakers.

Policymakers can use these findings to design interventions that effectively target these biases and increase female labor participation. For example, policies that promote gender equality in education and training programs for migrants. Moreover, the findings of this study can be useful for policymakers interested in promoting migration and female labor participation with real market outcomes like FDI.

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

Appave, G. and Sinha, N., editors (2017). *Migration in the 2030 Agenda*. International Organization for Migration, Geneva.

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.

Baier, S. L. and Bergstrand, J. H. (2007). Do free trade agreements actually increase members' international trade? *Journal of International Economics*, 71(1):72–95.

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.

Beverelli, C., Keck, A., Larch, M., and Yotov, Y. V. (2023). Institutions, trade, and development: identifying the impact of country-specific characteristics on international trade. *Oxford Economic Papers*, page gpad014.

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.

Du Rietz, A. and Henrekson, M. (2000). Testing the female underperformance hypothesis. *Small Business Economics*, 14:1–10.

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).

Edo, A. and Toubal, F. (2017). Immigration and the gender wage gap. *European Economic Review*, 92:196–214.

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.

Egger, P., Pirotte, A., and Titi, C. (2023). International investment agreements and foreign direct investment: A survey. *The World Economy.*

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.

Gil-Pareja, S., Llorca-Vivero, R., and Paniagua, J. (2022). Regional headquarters and foreign direct investment. *Review of International Economics*, 30(4):1288–1310.

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. *MPRA*, (No. 102598).

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.

Huang, J. and Kisgen, D. J. (2013). Gender and corporate finance: Are male executives overconfident relative to female executives? *Journal of Financial Economics*, 108(3):822–839.

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.

Johnson, M. and Keane, M. P. (2013). A dynamic equilibrium model of the us wage structure, 1968–1996. *Journal of Labor Economics*, 31(1):1–49.

Kraay, A. and Van der Weide, R. (2022). Measuring intragenerational mobility using aggregate data. *Journal of Economic Growth*, 27(2):273–314.

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.

Miyagiwa, K. and Papageorgiou, C. (2007). Endogenous aggregate elasticity of substitution. *Journal of Economic Dynamics and Control*, 31(9):2899–2919.

Nauerz, J. (2022). Men and Women at Work. Gains from individual taxation and macroeconomic importance of workforce diversity. *University of Notre Dame, mimeo.*

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.

Ottaviano, G. I., Peri, G., and Wright, G. C. (2018). Immigration, trade and productivity in services: Evidence from uk firms. *Journal of International Economics*, 112:88–108.

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.

Piyapromdee, S. (2021). The impact of immigration on wages, internal migration, and welfare. *The Review of Economic Studies*, 88(1):406–453.

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.

Santos Silva, J. M. C. 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. V. (2022). On the role of domestic trade flows for estimating the gravity model of trade. Technical Report 3.

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.

A Theoretical Appendix

A.1 Solution of the model for capital

We start by deriving the first-order conditions of the firm's problem:

$$\max_{S,S,L} \pi_j = \max\{p_j S^s K^k L^l - \alpha(w_{ij} S + r_j K + w_j L) - f_j\}.$$

Which are:

$$\frac{\partial \pi_j}{\partial S} = s p_j S^{s-1} K^k L^l = \alpha w_{ij} \tag{A.1}$$

$$\frac{\partial \pi_j}{\partial K} = k p_j S^s K^{k-1} L^l = \alpha r_j \tag{A.2}$$

$$\frac{\partial \pi_j}{\partial L} = l p_j S^s K^k L^{l-1} = \alpha w_j \tag{A.3}$$

From (A.2):

$$L^l = \frac{r_j\alpha}{kp_j} S^{-s} K^{1-k}, \tag{A.4}$$

now (A.4) in (A.1):

$$sp_j S^{s-1} K^k \frac{r_j\alpha}{kp_j} S^{-s} K^{1-k}, = \alpha w_{ij}, \tag{A.5}$$

we obtain the relationship between K and S:

$$K = \frac{kw_{ij}}{sr_j} S. \tag{A.6}$$

From (A.3):

$$S^s = \frac{\alpha w_j}{lp_j} K^{-k} L^{1-l} \tag{A.7}$$

now (A.7) in (A.2):

$$kp_j \frac{\alpha w_j}{lp_j} K^{-k} L^{1-l} K^{k-1} L^l = \alpha r_j \tag{A.8}$$

we obtain the relationship between K and L:

$$K = \frac{kw_j}{lr_j} L. \tag{A.9}$$

Substituting (A.6) in (A.9) we obtain the relationship between S and L:

$$L = \frac{lw_{ij}}{sw_j} S. \tag{A.10}$$

Substituting (A.6) and (A.10) in (A.2):

$$kp_j \left(\frac{sr_j}{kw_{ij}} K\right)^s K^{k-1} \left(\frac{lr_j}{kw_j} K\right)^l = \alpha r_j \rightarrow$$

$$kp_j \left(\frac{sr_j}{kw_{ij}}\right)^s K^{s+l+k-1} \left(\frac{lr_j}{kw_j}\right)^l = \alpha r_j. \tag{A.11}$$

And we obtain an expression for K:

$$K = \left(\frac{\alpha}{p_j} \cdot (r_j/k)^{1-s-l} (w_{ij}/s)^s (w_j/l)^l\right)^{\frac{1}{s+l+k-1}} \tag{A.12}$$

Now, for domestic firms $s = 0$ and $\alpha = \alpha^*$ and K^{Dom} in the paper:

$$K_j = \left(\frac{\alpha^*}{p_j} \cdot (r_j/k)^{1-l} (w_j/l)^l \right)^{\frac{1}{l+k-1}}, \tag{A.13}$$

and we can obtain an expression of foreign capital K in terms of domestic capital K^{Dom}:

$$K = \left(\frac{w_{ij}/s}{r_j/k} \right)^{\frac{s}{s+l+k-1}} \left((\alpha/\alpha^*)^{\frac{1}{l+k-1}} K_j \right)^{\frac{l+k-1}{s+l+k-1}} \tag{A.14}$$

with $\eta = s + l + k < 1$, we obtain equation (4) in teh text:

$$K = \left(\frac{1}{w_{ij}/r_j \cdot k/s} \right)^{\frac{s}{1-\eta}} (\alpha/\alpha^*)^{\frac{1}{\eta-1}} \left(K^{Dom} \right)^{\frac{\eta-1-s}{\eta-1}} \tag{A.15}$$