The Welfare Impact of Global Migration in the OECD Countries

A. Aubry and M. Burzyński

Discussion Paper 2013-35

Institut de Recherches Économiques et Sociales
de l'Université catholique de Louvain

IRES

UCL

The Welfare Impact of Global Migration in the OECD Countries

Amandine Aubry* Michał Burzyński†

preliminary draft, December 2013

Abstract

In this paper we investigate the impact of global migration on the welfare of native workers in the OECD countries. We develop a multi-country, general equilibrium model with trade and migration. Labor is assumed to be heterogeneous, whereas the wages, prices, trade flows, the mass of varieties of goods and the TFP levels are endogenized. The issue of the redistribution is also examined. The main result of this paper is the quantification of the welfare effects of migration for different groups of workers. These outcomes depend substantially on the size and the structure of migration in the OECD countries, and vary with educational levels of migrants. We consider the overall effect as a sum of three channels: the market size, wage and TFP effects. The key finding is that the market size effect plays a vital role in determining the benefits and costs of migration. Its consequences are prone to spillovers due to the international trade. Analyzing the shocks on the stock and the 1990-2000 flow of migrants, we discuss different patterns of the macroeconomic and welfare impacts of non-OECD (South-North) and OECD (North-North) migration. Nearly all the OECD countries benefit from the South-North migration. On the contrary, there are only few economies which are gaining from the North-North migration. Finally, we confirm a common belief that migration increases inequality between poor and wealthy citizens of the OECD countries, although this effect is mainly due to the intra-OECD emigration.

JEL Classifications: C68, F22, J24

Keywords: migration, market size, inequalities, general equilibrium, brain drain.

*IRES, Université catholique de Louvain

†IRES, Université catholique de Louvain and Poznan University of Economics, corresponding author.

The research is financed by the Polish Ministry of Higher Education and Science, the author benefits from the scholarship Mobility Plus awarded for polish researchers who do their research at foreign centers.
Corresponding author. Contact: *michal.burzynski@uclouvain.be*

1 Introduction

Migration is nowadays a growing phenomenon in the OECD countries. In 2013, only 3.2% of world population (which stands for over 220 million people) reached a decision to leave their domestic countries and settle in a new environment (United Nations). However, in the Western Europe and the United States, the share of migrants significantly exceeds 10%. Furthermore, the increasing mobility of people is visible not only in terms of the flows between the developed economies (the North-North migration), but also in the accelerated intensity of resettlements from the emerging and poor countries to the developed ones (the South-North migration). All these phenomena account for greater diversity in culture, language, skills and knowledge which induces both benefits and costs for the natives, measured by the gains and losses of their welfare.

The worldwide workers' mobility alters, in a complex way, the environment in which each of us lives, and leads to an understandable confusion. The latter is depicted in opinion polls and surveys showing that natives living in the developed countries are actually fearing immigration. Natives are often afraid of adverse labor market consequences, congestion and fiscal costs generated by an inflow of foreign workers. However, economists have not, so far, provided clear-cut answers to the question of the welfare impact of migration. Hitherto, there are only few general estimates that show the consequences of factor mobility. The majority of the literature concentrates on studies of particular implications of the growing markets integration: the role of the global increase in labor efficiency, the changes in prices of goods or the gains connected with enlarging the number of varieties available for consumption are, among other things, considered. Notwithstanding, those elements are interlinked, therefore without internalizing their complex interdependence, it is impossible to provide relevant estimations of the welfare impact of international migration. Both the development of new theoretical foundations and the construction of new data sets enable to provide some new results in this matter.

We aim at taking advantage of these new resources to investigate the impact of global migration on the welfare of natives in the OECD countries. We construct a multi-country, general equilibrium model with heterogeneous labor. We consider endogenous wages, TFP levels and numbers of varieties available for consumption and trade. Additionally, we include the redistributive transfers between high and low skilled workers. The setup is a natural extension of the well known model proposed by Krugman (1979) augmented with international migration. We quantify the impact of the South-North (S-N), as well as the North-North (N-N) migration on the welfare of natives in 34 OECD countries. This allows us to draw some interesting conclusions about the changes in real wages, inequalities and fiscal effects caused by migration from different sources. The calculations are done by conducting counter factual simulations (comprising of migration shocks) of the general equilibrium in the system of interconnected economies. Our model enables us to decompose the overall quantitative effect into three following channels: the wage effect, the total factor productivity (TFP) effect and the market size effect.

The migration of workers has a direct influence on the labor market equilibrium. Not only do the relative wages of low and high skilled people change, but also the gap between the remuneration of migrants and natives may be altered. These effects are the implications of the extent of substitution between different types of labor. In fact, in the presence of sound complementarities between domestic and foreign labor, an inflow of workers may actually have a positive wage effect for all natives. Then, immigration of high skilled labor positively influences the process of knowledge accumulation and technological progress. On the contrary, some developing countries suffer from the negative consequences of brain drain.[1] The impact of the TFP effect on welfare is a result of the research sector acceleration or externalities connected with a faster accumulation and exchange of knowledge. This, in turn, raises the average productivity of labor and contributes to a positive shift in its remuneration. Finally, an inflow of foreign people affects the demand for domestic goods. Simultaneously, it triggers the entries of companies and the introduction of new varieties of products. This market size effect is increasing in the size of population. In the environment in which consumers reveal the love of variety, it has a positive effect on total welfare. What is key, the international trade constitutes a vital channel through which the cross-country spillover effect of the market size takes place.

From the technical point of view, we would like to address the question of gains from migration in a multi-country framework, considering the above mentioned three channels. This issue needs a specific approach, the one which establishes the basics of the contemporary trade theory. This way of thinking about the consumer preferences, trade, imperfect competition and aggregation was proposed in the seminal papers by Spence (1976) and Dixit and Stiglitz (1977). The models of highly aggregated economic systems were then developed by Krugman (1979, 1980) as well as Grossman and Helpman (1989).

The model proposed in this paper firmly contributes to the literature on international trade and factor mobility. We describe the international flow of goods using a set of gravity-like equations, that are derived from the equilibrium conditions of the model. Our reference in this respect is the work by di Giovanni and Levchenko (2010) who build a stylized macroeconomic trade model based on Melitz (2003). In di Giovanni et al. (2012) the authors analyze the implications of both migration and flows of remittances.

However, our purpose is to address questions connected with the welfare impact of migration using an extremely clear model that can be easily calibrated and simulated. In such a way we are able to understand the significance of each channel through which migration affects the wellbeing of natives, and assess their quantitative importance. That is why we propose a simpler and more pedagogical theoretical structure. We consider homogeneous firms operating on a monopolistically competitive market. In each country there is only one sector of production (only consumption good, without intermediates). Labor is heterogeneous in terms of origin and skill level. Remittances are not modeled, due to the fact that they play a minor role in the developed, OECD countries. We believe that such a framework provides as good results as the more complicated one and is more manageable in terms of the decomposition of the effects of migration shocks. Moreover, the redistribution effects are added in order to measure the variations in intra-national inequalities.

The main findings of our paper are as follows. In the sample of 34 OECD countries, in year 2000, we obtain that the stock of migrants accounted for an overall average increase of 0.9% in the welfare of natives (the low skilled gained 1.1%, the high skilled gained 2.2%). The inflow of the non-OECD migrants had a positive welfare impact in almost all of the analyzed countries (on average 2.5%). However, the intra-OECD migration was strongly negative for the natives in 27 out of 34 countries (average decrease by 1.6%). The very same pattern is present when considering the 1990-2000 flow of migrants. Its positive effects account for an increase of the natives welfare by 0.6%. The recent migration was more beneficiary for the low skilled (gain of 1.0%) in comparison to the high skilled (gain of 0.6%). The

[1] For a complete survey see Docquier, Ozden, Peri (2013).

already present low skilled migrants lost 0.1% of their real wage, whereas the high skilled ones are worse off by about 2.1%. Therefore, migration between the developed countries brings benefits for only few countries (i.e. Australia, New Zealand, Canada, Israel, Luxembourg, Sweden, Switzerland and the U.S.). The rest encounters some severe losses in terms of the natives welfare. This result should encourage the authorities in the 27 countries to implement policies directed at retaining their precious human resources or attracting more foreign workers.

The above mentioned figures are then decomposed into three channels. Firstly, the nominal wages of natives decreased on average by 0.9% (a raise by 0.4% is due to the non-OECD migration, a drop of 1.3% is caused by the intra-OECD migration). The wage effect of the flow of recent migrants is slightly smaller, at the level of -0.2%. In our framework, we are able to isolate the long-run TFP effects. We model the increase in the productivity of labor following Lucas (1988) so that the variable describing the TFP is a product of a residual and a function of the high skilled share in population.[2] Such a mechanism gives an average negative impact of the stock of migration on TFP (decline at the level of 0.70%) and a slightly positive effect of the short-run migration (increase by 0.10%).

One of our most important results is, that the market size effect stands for the majority of the total welfare effect of migration. This is a firm confirmation of the result by di Giovanni et al. (2012), who find a very robust relation between the number of varieties available and the welfare of people. Considering the stock of South-North migration, we find that an average increase in the number of varieties available in the analyzed countries (which increased by 6.4% on average) accounts for a -2.0% change of the price indexes. Overall, including both the S-N and N-N migration, this effect is exactly -1.7% (due to 5.4% increase in the number of varieties). When analyzing the 1990-2000 migration flow, we observe a decrease of the average price index at the level of -0.8% due to the South-North migration and the overall effect of -0.7%. Therefore, in the light of the above mentioned aggregated results, the market size effect seems to be an important channel through which migration impacts welfare. Judging from our model, migration and international trade do not seem to be perfect substitutes.

Finally, we raise the question about the influence of global migration on the level of inequalities in the OECD countries. To quantify this, we calculate the relative changes in the Gini coefficients before and after the simulations. Additionally, we fit the redistribution rates between the high and the low skilled that match the relative changes in inequalities before and after the governmental interventions (in line with the work by Immervoll and Richardson (2011)). We find that migration increases the welfare disproportions, however this effect is mainly due to the intra-OECD migration, not the non-OECD migration. Therefore, one may state that inequalities are caused mainly by an outflow of high skilled workers (to other OECD countries), not by the inflow of low skilled workers from the developing countries.

The welfare impact of migration has been a subject of intensive and augmented inquiries in the recent years. The largest part of the hitherto research concentrates on the wage effects of migration in a simplified, homogeneous worker framework. Borjas (2009) examines the wage impact of immigration in a simple factor demand framework. He argues that in the short run immigration has a negative impact on the wage level and no effect is observed in the long run (assuming perfect substitution between these two types of labor). Simultaneously, taking the case of imperfect substitution, the impact on the wage level

[2] We do not consider positive spillover and diversity effects that may accompany the process of migration in the long run. We do not account for endogenous TFP progress. We believe that in the long run the TFP progress is intensively related to the stock of well educated workers who are well endowed in human capital.

brought about by a rise in the stock of immigrants is positive, but small. Moreover, the author concludes that in the presence of complementarities, immigration increases the wage inequalities between natives and migrants.[3] The wage effect of migration is analyzed by Docquier et al. (2013), who additionally assume an imperfect substitution between natives and migrants. They find that immigration is beneficial for the native Western European citizens due to the wage gain, whereas emigration of (mainly) high skilled workers causes a wage loss. Simultaneously, the authors argue that emigration has a negative impact on the wages of low skilled workers which, consequently, increases inequalities. Ottaviano and Peri (2012) find that in the period 1990-2006 immigration had a moderate effect on the wages of low skilled native workers (about $0.6-1.7\%$). It also had a noticeable positive effect on the average wages of natives (0.6%) and a substantial negative effect (-6.7%) on the wages of previous immigrants in the long run.

The combined wage and TFP effects of migration are analyzed by Peri et al. (2013). They investigate the impact of the flows of scientists, technology professionals, engineers and mathematicians in the U.S. on the relative wages of low and high skilled workers as well as the TFP growth between 1990 and 2010. The authors find that this type of migration has a significant positive effect on the wages of college-educated natives, and roughly no effect on the non-college-educated. However, the positive wage effect is diminished by the price effect brought about by an increase in housing rents.

The analysis of migration in a multi-country framework is done by Benhabib and Jovanovic (2012). They examine the question of the optimal level of migration from the point of view of the welfare. The answer is given using one-sector and two-sector models with trade. They state that the current level of migration is too low to provide the efficient solution in terms of welfare. Ortega and Peri (2012) show that an increase in migration openness is beneficial in terms of the long-run income, whereas the openness in trade has no significant impact. Their important result is that the main channel of this impact goes through the TFP effect (due to an increase of the variety of skills). Iranzo and Peri (2009) find that migration between Eastern and Western European countries was positive for the low skilled natives and high skilled migrants. They analyze the benefits of the reduction of migration costs for the Western European countries. What is crucial, the workers from the Eastern European countries are also better off due to trade. Di Giovanni and Levchenko (2012) use a multi-country model with cross-country differences in labor productivity, imperfect substitution between natives and migrants, as well as the flows of remittances from migrants to home countries. The authors report that the welfare impact of migration is large, estimated at the level of $5-10\%$ in the main receiving countries and about 10% in countries with large incoming remittances. This is due to the fact that those migrants who move from poor to rich countries experience a gain in productivity, which is a Pareto improvement. Thus, the destination economy benefits from higher production and enlarging the internal market, but simultaneously the source country is better off due to the flows of remittances.

The reminder of the paper is organized as follows. In the next section we present the theoretical model. We concentrate our analysis on the consumers' and firm' decisions. Then, we define the general

[3]The question of (im)perfect substitution between migrants and natives was a bone of contention between Ottaviano and Peri (2012) and Borjas et al. (2008). The first group of authors estimated the elasticity of substitution between foreign and domestic workers at the level of 20. This has a crucial importance when one considers the impact of migrants on natives' wages. Namely, imperfect substitution allows for a positive relation between the stock of migrants and the wages of natives. On the other hand, the second group of authors argues that the above results are vague and are susceptible to the introduction of heterogeneity of labor in terms of education and experience.

equilibrium of the multi-country model. In the third section we describe the solution algorithm, the calibration strategy and we show the model fit. Section 4 is devoted to the analysis of the simulation results. In section 5 we report the robustness check with respect to the key parameters of the model. Section 6 concludes.

2 The Model

We extend the multi-country model proposed by Dixit-Stiglitz (1977) and Krugman (1979). We consider a simple, static system of N (potentially asymmetric) countries indexed by $i \in \{1, 2, ..., N\}$. Each economy is endowed with an exogenous labor force, whose efficient stock is denoted by $\bar{L}_i^T$, which is composed of natives and immigrants, who can be either low or high skilled. Labor is the only input for production. In country i, there is a mass B_i of firms which produce differentiated varieties of the consumption good.[4] Homogeneous firms decide about the optimal demand for different types of labor inputs and set the monopolistic price. They operate on a monopolistically competitive market, therefore they obtain operational profits due to positive market power. However, these benefits are zeroed by the fixed cost of production. The mobility of goods and people is assumed. Each pair of economies can perform a bilateral exchange of varieties produced by local manufacturers. Simultaneously, people can migrate from one country to another. The former process is endogenous, whereas the latter takes the form of exogenous shocks. In the equilibrium the product and labor markets clear, and consumers choose the optimal bundle of varieties. The equilibrium mass of firms is limited by the country specific free entry condition which is binding if and only if the operational profits are equal to the fixed cost of production.

2.1 Consumers' Decisions

We assume a simple environment, in which individuals inelastically supply one unit of labor (either high or low skilled) and gain utility from consuming different varieties of the consumption good. We distinguish four groups of workers which are labeled by: nl for native low skilled, nh for native high skilled, fl for foreign low skilled and fh for foreign high skilled workers. By L_i^s we denote the number of workers of type s, so that the total working population in country i is equal to: $L_i^T = \sum_{s\in\{nl,nh,fl,fh\}} L_i^s$. Agents are remunerated according to the type of labor they supply. Individuals are endowed with homothetic preferences described by a constant elasticity of substitution (CES) utility function defined over a continuum of varieties of the consumption good. The consumers in country $i \in N$, supplying labor of type $s \in \{nl, nh, fl, fh\}$, maximize their utility:

$$U_i^s = \left(\sum_{j\in N_i} \int_{k\in B_j} x_{ij}^s(k)^{\frac{\epsilon-1}{\epsilon}} dk \right)^{\frac{\epsilon}{\epsilon-1}}, \tag{1}$$

where the double subscript ij denotes j's exports to country i.[5] The set of countries that export to country i is denoted by N_i, whereas B_j is the mass of varieties produced in country j. The varieties are imperfect substitutes, with an elasticity of substitution equal to $\epsilon > 1$.

[4] The symbol B_i is used to describe the set of varieties as well as its cardinality, the meaning is clear from the context.

[5] In other words, $x_{ij}^s(k)$ stands for the amount of variety k produced in country j, exported and consumed by an individual from group s in country i.

Agents in country i solve the utility maximization problem subject to the budget constraint:

$$\sum_{j\in N_i}\int_{k\in B_j} p_{ij}(k)x_{ij}^s(k)dk = \tilde{w}_i^s, \tag{2}$$

where $\tilde{w}_i^s$ represents the net (after redistribution) nominal remuneration of a worker of type s who lives in country i. Considering the CES preferences, each individual spends all her income on consumption and every available variety is consumed (because: $\lim_{x_{ij}^s(k)\to 0}\frac{\partial U_i^s}{\partial x_{ij}^s(k)} = \infty$). The solution to the utility maximization problem (1) subject to the budget constraint (2) is given by the following demand function:

$$x_{ij}^s(k) = \frac{p_{ij}(k)^{-\epsilon}}{P_i^{1-\epsilon}}\tilde{w}_i^s. \tag{3}$$

where P_i denotes the ideal price index in country i.

We assume that selling goods abroad is costly, and this cost is covered by the buyers. Consequently, the actual price of a good manufactured in country j and consumed in country i is equal to the initial price determined by the producer ($p_j(k)$) multiplied by the iceberg trade cost: $p_{ij}(k) = p_j(k)\tau_{ij},\ \tau_{ij}\geq 1$. The opening of the market of goods causes that the price level in a given country is affected by the prices set by both home manufacturers and the trading partners. Moreover, the prices of imported varieties are dependent on the bilateral trading costs. The price index in country i is expressed as:

$$P_i = \left[\sum_{j\in N_i}\int_{k\in B_j} p_{ij}(k)^{1-\epsilon}dk\right]^{\frac{1}{1-\epsilon}}. \tag{4}$$

Notice that the higher the price of a given good, the smaller its impact on the aggregated price index. Equivalently, assuming that all the firms in each country $j\in N$ are homogeneous in terms of their technology level (so that $\forall k\ p_i(k) = p_i$) and their distribution in the set B_j is uniform, we can rewrite the ideal price index as:

$$P_i = \left[\sum_{j\in N_i} B_j\left(\tau_{ij}p_j\right)^{1-\epsilon}\right]^{\frac{1}{1-\epsilon}}. \tag{5}$$

The price index (5) captures the property of the love of variety underlined by the CES utility function (1). A growth in the number of varieties consumed (keeping consumer's expenditure unchanged), leads to an increase in the level of utility and a decrease in the price index. Consider the individual indirect utility function:

$$U_i^s = \left(\sum_{j\in N_i}\int_{k\in B_j}\left(\frac{p_{ij}(k)^{-\epsilon}}{P_i^{1-\epsilon}}\tilde{w}_i^s\right)^{\frac{\epsilon-1}{\epsilon}}dk\right)^{\frac{\epsilon}{\epsilon-1}} = \frac{\tilde{w}_i^s}{P_i}.$$

Notice that $\frac{\partial P_i}{\partial B_j} < 0$, so $\frac{\partial U_i^s}{\partial B_j} > 0$.[6] The latter expression is the love of variety property. The former inequality suggests that P_i is a measure of the degree of tightness of competition in country i. Larger number of available varieties means lower price index. Another important consequence of assuming the

[6]Consider that in a single country framework $\forall k\ p_{ij}(k) = p$. Now: $P_i = \left(\int_{B_i} p^{1-\epsilon}dk\right)^{\frac{1}{1-\epsilon}} = pB_i^{\frac{1}{1-\epsilon}}$. Finally we have that: $U_i^s = B_i^{\frac{1}{\epsilon-1}}w_i^s/p$.

Dixit-Stiglitz utility is that the ideal price index is a cost of a unit of utility.[7]

The question of inequalities caused by international flows of people is a currently discussed problem in the debate on the global consequences of migration. That is why, we want to quantify the impact of migration on the measures of inequality in the analyzed countries. Furthermore, the issue of national welfare redistribution policies among people of different skills is addressed. We assume that in every country the high skilled workers have to pay a lump sum tax on their income, which is then transfered to the low skilled agents.[8] Therefore, the after tax income of a high skilled worker is equal to: $\tilde{w}_i^s = (1-t_i)w_i^s$ for $s \in \{nh, fh\}$ and the income of a low skilled after the transfer equals: $\tilde{w}_i^s = (1+s_i)w_i^s$ for $s \in \{nl, fl\}$. Furthermore, we set a governmental budget constraint:

$$t_i \left(X_i^{nh} + X_i^{fh} \right) = s_i \left(X_i^{nl} + X_i^{fl} \right), \tag{6}$$

where X_i^s is the aggregated gross remuneration of the group s in country i.

2.2 Firms' Decisions

In each country i, there is a continuum of homogeneous firms, each choosing to produce a different variety $k \in B_i$. They operate on a monopolistically competitive market. Production requires only one input, labor, which is supplied inelastically. The aggregate level of efficient labor $\bar{L}_i^T$ stands for the country i's size index. As described in the previous section, the labor supply can be decomposed into its efficient high skilled component $\bar{L}_i^h$ and its efficient low skilled component $\bar{L}_i^l$. Both of these aggregates are composed of natives and immigrants. The skill- and origin-specific supply of labor (expressed in the number of people) is denoted by: L_i^{nl} and L_i^{nh} for natives and L_i^{fl} and L_i^{fh} for foreigners.

Different wages are assigned to each type of labor. The remuneration of the efficient low skilled (high skilled) component, is equal to w_i^l (w_i^h). As the high skilled workers are more productive, we generally observe that $w_i^h > w_i^l$. In particular, the low skilled domestic and foreign workers get w_i^{nl} and w_i^{fl} respectively, while the high skilled natives and immigrants earn w_i^{nh} and w_i^{fh} respectively.

2.2.1 Optimal Labor Demand

Each firm $k \in B_i$ needs both low and high skilled workers to run its production process, therefore it faces a two-stage decision about optimizing its labor demand. Firstly, it chooses between the number of low and high skilled workers, $\bar{\ell}_i^l(k)$ and $\bar{\ell}_i^h(k)$. Secondly, the firm chooses between natives and migrants for each skill level $t \in \{l, h\}$, that is: $\ell_i^{nt}(k)$ and $\ell_i^{ft}(k)$. Both of these decisions are taken under the assumption that the company wants to minimize its variable cost of production. This concept is captured by the following, firm-specific, nested CES production function:

$$y_i(k) = A_i \bar{\ell}_i^T(k) = A_i \left(\theta_i^H \left(\bar{\ell}_i^h(k) \right)^{\frac{\sigma-1}{\sigma}} + \left(1 - \theta_i^H\right) \left(\bar{\ell}_i^l(k) \right)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \qquad \sigma > 1, \tag{7}$$

[7] The equation for the price index in country i may also be derived from the following equilibrium condition. Considering the CES preferences of each consumer, the aggregated expenditures in country i has to be equal to the value of the demand for all available varieties: $X_i = \sum_{j \in N_i} p_{ij} x_{ij} B_j$. Using the optimal demand functions, we get: $X_i = \sum_{j \in N_i} \left(\frac{p_{ij}}{P_i} \right)^{1-\epsilon} X_i B_j$. Therefore: $P_i^{1-\epsilon} = \sum_{j \in N_i} B_j p_{ij}^{1-\epsilon}$, which is equivalent to the equation (5).

[8] In terms of the redistribution, native and foreign workers are treated equally.

where $\bar{\ell}_i^T(k)$ is the efficient labor supply, $\bar{\ell}_i^h(k)$ and $\bar{\ell}_i^l(k)$, are the composites of efficient high skilled and low skilled labor respectively (defined below), employed by a company k in country $i \in N$. The economy-specific total factor productivity (TFP), A_i, is defined as a product of an exogenously given residual $\bar{A}_i$ and the economy-specific skill rate component, g_i:

$$A_i = \bar{A}_i g_i^{\lambda}, \qquad g_i = \frac{1}{L_i^T} \int_{k \in B_i} \left(\ell_i^{nh}(k) + \ell_i^{fh}(k) \right) dk = \frac{L_i^{nh} + L_i^{fh}}{L_i^{nl} + L_i^{nh} + L_i^{fl} + L_i^{fh}},$$

where g_i is the ratio of the high skilled labor to total labor supply and λ is the elasticity of A_i with respect to g_i. Furthermore, $\sigma \in (1, \infty)$ is the elasticity of substitution between high skilled and low skilled workers capturing the imperfect substitutability between workers of different skill levels. The assumed form of the production function is separable in high skilled and low skilled workers which allows to distinguish the high skilled wage index w_i^h from the low skilled wage index w_i^l. Finally, country-specific θ_i^H captures the share of the efficient high skilled labor in creating the value added, that is the firm's preference for the high and low skilled workers.

The composites of the efficient labor supplies are defined as:

$$\begin{aligned} \bar{\ell}_i^l(k) &= \left[\theta_i^M \left(\ell_i^{nl}(k) \right)^{\frac{\sigma_M - 1}{\sigma_M}} + \left(1 - \theta_i^M\right) \left(\ell_i^{fl}(k) \right)^{\frac{\sigma_M - 1}{\sigma_M}} \right]^{\frac{\sigma_M}{\sigma_M - 1}}, \\ \bar{\ell}_i^h(k) &= \left[\theta_i^M \left(\ell_i^{nh}(k) \right)^{\frac{\sigma_M - 1}{\sigma_M}} + \left(1 - \theta_i^M\right) \left(\ell_i^{fh}(k) \right)^{\frac{\sigma_M - 1}{\sigma_M}} \right]^{\frac{\sigma_M}{\sigma_M - 1}}, \end{aligned} \tag{8}$$

where the country-specific θ_i^M captures the domestic workers' share in production (firm's preference for the natives in comparison to immigrants), whereas $\sigma_M \in (1, \infty)$ is the elasticity of substitution between domestic and foreign labor.

Firms face a two-stage decision about the optimal choice of the employment of different types of workforce. First, they solve the problem (P1) of choosing high and low labor composites:

$$\min_{\bar{\ell}_i^h(k), \bar{\ell}_i^l(k)} \; w_i^h \bar{\ell}_i^h(k) + w_i^l \bar{\ell}_i^l(k)$$

$$s.t. \; A_i \left(\theta_i^H \left(\bar{\ell}_i^h(k) \right)^{\frac{\sigma - 1}{\sigma}} + \left(1 - \theta_i^H\right) \left(\bar{\ell}_i^l(k) \right)^{\frac{\sigma - 1}{\sigma}} \right)^{\frac{\sigma}{\sigma - 1}} \geq y_i(k).$$

The optimal labor demand for efficient low and high skilled aggregates, for a given level of production $y_i(k)$ is given by:

$$\bar{\ell}_i^h(k) = \frac{y_i(k)}{A_i} \left(\frac{w_i^h}{\theta_i^H W_i} \right)^{-\sigma}, \qquad \bar{\ell}_i^l(k) = \frac{y_i(k)}{A_i} \left(\frac{w_i^l}{(1 - \theta_i^H) W_i} \right)^{-\sigma}, \tag{9}$$

where W_i is the aggregate wage index:

$$W_i = \left[\left(\theta_i^H \right)^{\sigma} \left(w_i^h \right)^{1 - \sigma} + (1 - \theta_i^H)^{\sigma} \left(w_i^l \right)^{1 - \sigma} \right]^{\frac{1}{1 - \sigma}}. \tag{10}$$

The variable unit cost is then equal to:

$$c_i(k) = c_i = \frac{w_i^h \bar{\ell}_i^h(k) + w_i^l \bar{\ell}_i^l(k)}{y_i(k)} = \frac{W_i}{A_i}. \tag{11}$$

Equation (9) shows that the demand for each type of efficient labor aggregate depends positively on the level of production $y_i(k)$ and on the share of this input in creating the value added (which is θ_i^H for high skilled labor and $1-\theta_i^H$ for the low skilled labor). Since $y_i(k)$ is proportional to the TFP, a change in A_i has no effect on the demand for labor. Furthermore, $\bar{\ell}_i^h(k)$ and $\bar{\ell}_i^l(k)$ depend negatively on the cost of labor, that is w_i^h and w_i^l. The imperfect substitution between the inputs, leads to the fact that the labor demand for each skill level is a function of all inputs' prices (through the aggregate wage index W_i). Then, the higher the elasticity of substitution between the two types of workforce σ, the higher the demand for the relatively cheaper type of labor.

For both skill levels, firms can choose between hiring either natives or migrants. In general, the domestic workers are more productive but also more expensive. That is why, firms face the following cost minimization problem of choosing the optimal combination of domestic and foreign workers, taking the total supply of efficient high (low) skilled labor as given (see (9)). For every skill level $t \in \{l, h\}$ firms solve the minimization program (P2):

$$\min_{\ell_i^{nt}(k), \ell_i^{ft}(k)} \quad w_i^{nt}\ell_i^{nt}(k) + w_i^{ft}\ell_i^{ft}(k)$$

$$s.t. \quad \left(\theta_i^M \left(\ell_i^{nt}(k)\right)^{\frac{\sigma_M - 1}{\sigma_M}} + \left(1-\theta_i^M\right)\left(\ell_i^{ft}(k)\right)^{\frac{\sigma_M-1}{\sigma_M}}\right)^{\frac{\sigma_M}{\sigma_M - 1}} \geq \bar{\ell}_i^t(k).$$

The optimal labor demands for natives and migrants of a skill level $t \in \{l, h\}$ are then equal to:

$$\ell_i^{nt}(k) = \bar{\ell}_i^t(k)\left(\frac{w_i^{nt}}{\theta_i^M w_i^t}\right)^{-\sigma_M}, \qquad \ell_i^{ft}(k) = \bar{\ell}_i^t(k)\left(\frac{w_i^{ft}}{(1-\theta_i^M)w_i^t}\right)^{-\sigma_M}, \tag{12}$$

where w_i^t is the remuneration of the efficient low (high) skilled labor composite from the problem (P1), which we refer to as a wage index for the skill level $t \in \{l, h\}$:

$$w_i^t = \left[\left(\theta_i^M\right)^{\sigma_M}\left(w_i^{nt}\right)^{1-\sigma_M} + \left(1-\theta_i^M\right)^{\sigma_M}\left(w_i^{ft}\right)^{1-\sigma_M}\right]^{\frac{1}{1-\sigma_M}}. \tag{13}$$

The variable unit cost of the labor is characterized by the skill level t equals its gross remuneration:

$$w_i^t = \frac{w_i^{nt}\ell_i^{nt}(k) + w_i^{ft}\ell_i^{ft}(k)}{\bar{\ell}_i^t(k)}. \tag{14}$$

Taking (12), we get that the relation between the demands for natives and immigrants for $t \in \{l, h\}$ is:

$$\frac{\ell_i^{nt}(k)}{\ell_i^{ft}(k)} = \left(\frac{w_i^{ft}}{w_i^{nt}}\frac{\theta_i^M}{(1-\theta_i^M)}\right)^{\sigma_M} \tag{15}$$

This ratio depends on the elasticity of substitution between migrants and natives σ_M, on their relative productivity, as well as their relative cost. The higher the level of this substitution, the larger is the impact of their cost difference on their relative demand.

2.2.2 Profit Maximization Problem

In every country, each firm is the only producer of the variety $k \in B_i$, therefore it is endowed with monopoly power. After having optimized its demand for labor inputs the entrepreneur sets the price of its product so that the profit is maximized. Due to the assumption about the utility function, consumers in every country demand a positive quantity of every variety, as long as the bilateral trading cost between production and destination countries is finite. That is why each firm produces not only for the domestic market, but also for all the other $N-1$ international markets. These features of the aggregated demand for a particular variety k have to be taken into consideration while analyzing the profit maximization problem.

Firms choose the total production level (denoted by $y_i(k)$ for firm k in country i) according to the demand function (expressed by (3)). Therefore, for any variety produced in country i and exported to country j, we obtain:

$$y_i(k) = \sum_{j:\ i\in N_j} \tau_{ji} y_{ji}(k) = \sum_{j:\ i\in N_j} \tau_{ji} \frac{(p_{ji}(k))^{-\epsilon}}{P_j^{1-\epsilon}} X_j, \tag{16}$$

where $p_{ji}(k) = \tau_{ji} p_i(k)$ is the final price of a variety k produced in country i and exported to country j.

Firms that operate on the monopolistically competitive market solve their variable profit maximization problem (P3):

$$\max_{p_i(k)} \Pi_i(k) = y_i(k)\,(p_i(k) - c_i(k)). \tag{17}$$

Provided, there is a continuum of firms, entrepreneurs face a residual demand curve with a constant elasticity of substitution equal to ϵ. They choose the price equal to the marginal cost of production multiplied by a constant markup. Therefore, the optimal price of any variety is equal to:

$$p_i(k) = p_i = \frac{\epsilon}{\epsilon - 1} c_i = \frac{\epsilon}{\epsilon - 1} \frac{W_i}{A_i} \tag{18}$$

A higher elasticity of substitution between goods (which decreases the monopoly power of manufacturers) yields a markup closer to unity, which reduces the profits gained by the entrepreneurs.

2.2.3 The Free Entry Condition

Considering the fact that the market for each variety is monopolistically competitive, there must be some incentive for entrepreneurs to enter and exit the production sector of the economy. In order to have that the measure of the set of firms, B_i, is finite in every country, we impose barriers to create businesses. Therefore, the aggregate output and the production per firm is determined by the free entry condition:

$$(p_i - c_i)\, y_i(k) = W_i f_i,$$

in particular, knowing the pricing rule $p_i = \frac{\epsilon}{\epsilon-1} c_i$, we get:

$$p_i y_i(k) = \epsilon W_i f_i. \tag{19}$$

The free entry condition, equalizes the revenue of each firm in country i to the value of the fixed cost of production, f_i, which is assumed to be expressed in the units of the efficient labor composite.[9] Consequently, the cost of a unit of a fixed input is equal to the price index W_i. The free entry and exit of firms implies that the profits of all firms operating on the market are equal to zero:

$$\sum_{j:\, i \in N_j} \left(\frac{\tau_{ji} p_i}{P_j} \right)^{1-\epsilon} X_j = \epsilon W_i f_i \tag{20}$$

2.3 The Aggregated Behavior

In the previous subsections, all the decisions were analyzed from the point of view of individual agents (either consumers or firms). Now, we want to generalize the former results and express them in an aggregated manner. Summing all the individual demands for good k produced in country j and consumed in country i by agents of type $s \in \{nl, nh, fl, fh\}$, we obtain:

$$x_{ij}^s(k) = \frac{p_{ij}(k)^{-\epsilon}}{P_i^{1-\epsilon}} \tilde{w}_i^s L_i^s. \tag{21}$$

Knowing that all firms in country i are homogeneous in terms of their production cost, we drop the index k and express all the variables in aggregates across all firms in a given country. Therefore, we write: $\int_{B_i} y_i(k)dk = Y_i$, $\int_{B_i} \ell_i^s(k)dk = L_i^s$ for $s \in \{nl, nh, fl, fh\}$ and $\int_{B_i} \bar{\ell}_i^s(k)dk = \bar{L}_i^s$ for $s \in \{l, h\}$.

Having considered the above mentioned statements, we can sum the no-entry condition over all firms in country i, which gives us:

$$X_i = B_i \epsilon W_i f_i. \tag{22}$$

From the individuals' aggregated budget constraint:

$$X_i = L_i^{nl} w_i^{nl} + L_i^{nh} w_i^{nh} + L_i^{fl} w_i^{fl} + L_i^{fh} w_i^{fh} = \bar{L}_i^l w_i^l + \bar{L}_i^h w_i^h = \bar{L}_i^T W_i, \tag{23}$$

one derives the number of varieties produced in country i:

$$B_i = \frac{\bar{L}_i^T}{\epsilon f_i}. \tag{24}$$

The measure of the size of country i's market, B_i (that is the mass of companies that run production in country i) is a function of three factors. First of all, it is proportional to the size of the country, $\bar{L}_i^T$ that measures the demand capacity of the home market. Secondly, the mass of varieties is inversely proportional to the elasticity of substitution between varieties. Higher elasticity means more competition between firms and lower number of entries. Finally, B_i is inversely proportional to the fixed cost of production, f_i meaning that the institutional easiness of establishing new companies spurs entrepreneurship and increases the mass of companies operating on the market (that, *ceteris paribus*, raises the utility of citizens).

[9] We assume that firms have an access to perfect information about the costs of entry, thus they will be indifferent between paying the one time investment cost $\bar{f}_i$ and the amortized, discounted per-period portion of this cost $f_i = \bar{f}_i / d_i$. In a dynamic framework, d_i would be the expected age of a firm operating in country i.

2.4 The Definition of the General Equilibrium

After deriving the optimal conditions describing the behavior of consumers and firms, we proceed with the definition of the general equilibrium of the system of N economies. We therefore impose the market clearing conditions on the consumption good and labor markets.

2.4.1 The Consumption Good Market Clearing Conditions

In order to simplify the notation, let X_{ji} be the value of export from country i to country j. Formally:

$$X_{ji} > 0 \leftrightarrow i \in N_j \quad \& \quad \forall i \in N \; X_{ii} > 0. \tag{25}$$

Then, we have that the total GDP in country i is equal to the total exports to all countries $i \in N_j$, including the domestic market, or simply:

$$X_i = \sum_{j=1}^{N} X_{ji}. \tag{26}$$

The total export from country i to country j is the value of the production of all firms in country i devoted to the country j[10]. This value of trade depends on the demand by consumers in country j which in turn relies on the price of the exported product and the cost of trade:

$$X_{ji} = \int_{k \in B_i} x_{ji} p_{ji} dk = B_i X_j \left(\frac{\tau_{ji} p_i}{P_j} \right)^{1-\epsilon}. \tag{27}$$

Consequently:

$$X_i = B_i \sum_{j=1}^{N} X_j \left(\frac{\tau_{ji} p_i}{P_j} \right)^{1-\epsilon}. \tag{28}$$

Substituting for B_i in the equation for bilateral value of trade (27), we obtain a representation that is in line with the standard gravity model:

$$\frac{X_{ji}}{X_i} = \frac{X_j \left(P_j / \tau_{ji} \right)^{\epsilon-1}}{\sum_{h=1}^{N} X_h \left(P_h / \tau_{hi} \right)^{\epsilon-1}}. \tag{29}$$

From the equation (29) we can clearly see that the share of export to country j to GDP is increasing in the price index of the recipient country and its size (measured by GDP). High value of the price index means low competition between firms which leads foreign firms to enter the market and profit from either high margins or from their cost advantage. On the contrary, the share of export to GDP is decreasing in the cost of trade.

In the considered model there is only one international market (on which different varieties of the final good are traded) and only one sector of the economy. For simplicity, we disregard the possibility to transfer resources through the capital, financial or debt market. That is why imposing an equilibrium on the balance of payments means equalizing its values of export and import: $\sum_j X_{ij} = \sum_j X_{ji}$.[11]

[10] All firms take part in the exchange process due to their homogeneity, all firms serve all markets due to the CES utility of all consumers.

[11] To check that this holds, put the equation (27) into the definition of the price index and use the definition of the GDP.

2.4.2 The Labor Market Clearing Conditions

The remunerations of domestic and foreign workers with low and high skills (w_i^{nl}, w_i^{nh}, w_i^{fl}, w_i^{fh} respectively) are determined from the equalization of the aggregated demand for each type of labor and the exogenously given supply. Having these values, it is possible to set the wages of the two composites of efficient low and high skilled labor (w_i^l and w_i^h) and the overall wage index W_i.

When deriving the aggregated demand for labor, it is important to notice that not all resources are assigned to production of the final good. Consequently, the efficient supply of labor used in manufacturing is smaller than $\bar{L}_i^T$. According to this, only the share $\frac{\epsilon-1}{\epsilon}$ of gross production is used for consumption, the rest is allocated to the fixed cost of entry.

The total labor not devoted to production is $B_i f_i$, whose cost is equal to $B_i f_i W_i$. The total share of efficient labor devoted to creating firms is equal to:

$$\xi \equiv \frac{f_i B_i W_i}{W_i \bar{L}_i^T} = \frac{1}{\epsilon} \tag{30}$$

Furthermore, the share of workers that are producing the final good is $1-\xi$.[12]

Considering the equation (30) and the optimal labor allocations we can arrive at the labor market clearing conditions. The demand functions for low (high) skilled domestic (foreign) labor are given by the first order conditions (12) of the firms' problems (P2). We also know the demand for the aggregate levels of efficient low (high) skilled labor, that is the first order condition (9) of the firms' problems (P1). After the aggregation, we arrive at:

$$\begin{aligned}
L_i^{nl} &= (1-\xi)\bar{L}_i^T (1-\theta_i^H)^{\sigma} \left(\theta_i^M\right)^{\sigma_M} \left(w_i^l\right)^{\sigma_M-\sigma} (w_i^{nl})^{-\sigma_M} \left(W_i\right)^{\sigma}, \\
L_i^{nh} &= (1-\xi)\bar{L}_i^T \left(\theta_i^H\right)^{\sigma} \left(\theta_i^M\right)^{\sigma_M} \left(w_i^h\right)^{\sigma_M-\sigma} \left(w_i^{nh}\right)^{-\sigma_M} \left(W_i\right)^{\sigma}, \\
L_i^{fl} &= (1-\xi)\bar{L}_i^T (1-\theta_i^H)^{\sigma} (1-\theta_i^M)^{\sigma_M} \left(w_i^l\right)^{\sigma_M-\sigma} (w_i^{fl})^{-\sigma_M} \left(W_i\right)^{\sigma}, \\
L_i^{fh} &= (1-\xi)\bar{L}_i^T \left(\theta_i^H\right)^{\sigma} (1-\theta_i^M)^{\sigma_M} \left(w_i^h\right)^{\sigma_M-\sigma} (w_i^{fh})^{-\sigma_M} \left(W_i\right)^{\sigma},
\end{aligned} \tag{31}$$

where:

$$\begin{aligned}
w_i^l &= \left[\left(\theta_i^M\right)^{\sigma_M} \left(w_i^{nl}\right)^{1-\sigma_M} + \left(1-\theta_i^M\right)^{\sigma_M} (w_i^{fl})^{1-\sigma_M}\right]^{\frac{1}{1-\sigma_M}}, \\
w_i^h &= \left[\left(\theta_i^M\right)^{\sigma_M} \left(w_i^{nh}\right)^{1-\sigma_M} + \left(1-\theta_i^M\right)^{\sigma_M} (w_i^{fh})^{1-\sigma_M}\right]^{\frac{1}{1-\sigma_M}}, \\
W_i &= \left[\left(\theta_i^H\right)^{\sigma} \left(w_i^h\right)^{1-\sigma} + (1-\theta_i^H)^{\sigma} \left(w_i^l\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}}.
\end{aligned}$$

Taking $L_i^{nl}, L_i^{nh}, L_i^{fl}, L_i^{fh}$ as the exogenously given values of labor supplies, for every country i we obtain a system of four implicit equations with four unknowns: $w_i^{nl}, w_i^{nh}, w_i^{fl}, w_i^{fh}$. Thus, the equilibrium wages are given by the solution to the system (31).

2.4.3 The General Equilibrium

The general equilibrium in the system of N economies, taking $\{[X_i]_{i\in N}, [\bar{A}_i]_{i\in N}, [g_i]_{i\in N}, [\bar{L}_i^T]_{i\in N}, [f_i]_{i\in N}\}$ as given, is defined as the set of vectors $\{[P_i]_{i\in N}, [B_i]_{i\in N}, [W_i]_{i\in N}\}$ and the matrix of bilateral trade

[12] We assume that both the marginal entrepreneur and the marginal worker are remunerated identically, so that those two agents are indifferent between being employed and opening a firm.

$[X_{ij}]_{i,j \in N}$ that for every country $i \in N$ satisfy:

$(E1)$	$X_i = W_i \bar{L}_i^T$
$(E2)$	$X_i = \sum_{j=1}^{N} X_{ji} = \sum_{j=1}^{N} X_{ij}$
$(E3)$	$\sum_{j:\ i \in N_j} \left(\frac{\tau_{ji} p_i}{P_j}\right)^{1-\epsilon} X_j = \epsilon W_i f_i$
$(E4)$	$\bar{L}_i^T = \epsilon B_i f_i$
$(E5)$	$c_i = W_i / A_i$
$(E6)$	$\forall k \ p_i(k) = p_i = \frac{\epsilon}{\epsilon - 1} c_i$
$(E7)$	$P_i = \left[\sum_{j \in N_i} B_j \left(\tau_{ij} p_j\right)^{1-\epsilon}\right]^{\frac{1}{1-\epsilon}}$
$(E8)$	$W_i = W_i(w_i^{nl}, w_i^{nh}, w_i^{fl}, w_i^{fh})$

The condition $(E1)$ states that the agents spend all their income on consumption. $(E2)$ is the multi-country market clearing condition followed by the trade balance equilibrium. $(E3)$ is the consequence of the free entry of firms. Condition $(E4)$ describes the the equilibrium number of varieties produced in country i. $(E5)$ means that the only input for production is (heterogeneous) labor and firms minimize the cost of it (problems (P1) and (P2) respectively). Then, $(E6)$ is the outcome of firms' profit maximization programs (P3). Equation $(E7)$ defines the country-specific price index. The labor market clearing condition, being the solution to the system (31), is stated in a short representation as $(E8)$.

3 The Calibration of the Model

In this section we discuss the methods of solution and the calibration of the model and we describe our empirical estimation of the bilateral costs of trade. Furthermore, we show how the model fits the actual macroeconomic data, including the intra-OECD trade matrix.

3.1 The Proceeding Algorithm

In order to solve the model, we use the eight equilibrium conditions per country to arrive at a system of N unknowns and N equations. We first solve for the labor market equilibrium, (E8) which is completely dependent on the structure of population in a given country. From this step, the relations between different types of wages: $w_i^{nl}, w_i^{nh}, w_i^{fl}, w_i^{fh}$ are derived. We choose the wage index, W_i, in such a way that its product with the efficient labor force $\bar{L}_i^T$ gives exactly the country's GDP (i.e. the equilibrium condition (E1)). Thus, all the wages are well defined in monetary units. As we consider the general equilibrium, we need to define a numéraire that would be constant throughout all the simulations. We decide that the wage index for the United States is the best choice, because all the monetary values are expressed in USD.

In the second step we plug the equilibrium conditions (E4) to (E7) into the zero-profit condition (E3) which enables us to build a square N-dimensional system of nonlinear equations. The only endogenous variable that has to be calibrated is the TFP parameter $[A_i]_{i \in N}$. In fact, in the back-solving procedure, we only fit the TFP residuals: $[\bar{A}_i]_{i \in N}$. Iteratively, imposing a fixed precision on the estimates, we calculate the values of the residuals to perfectly fit the cross-country GDP data and to satisfy the zero-profit equilibrium condition country by country.

The last part of the solution of the model is the computation of the equilibrium masses of varieties B_i, price indexes P_i, as well as the implied trade matrix X. The latter is constrained by the trade-balance equilibrium condition (E2) and the gravity equation (29).

After imposing an exogenous migration shock, which changes the labor supply in each country, we proceed in the following way. We solve the model, taking the vector $[\bar{A}_i]_{i\in N}$ as exogenous and $[W_i]$ as an endogenous vector of unknowns. In an iterative procedure we solve for the wage indexes, which then define the GDP levels and the price indexes in all countries.

For the sake of clarity we explain the calibration in three steps. Firstly, we concentrate on the exogenous variables. Secondly, we discuss the process of estimation of the bilateral ice-berg costs of trade. Finally, we explain the values of the parameters.

3.2 Exogenous Variables

All the quantitative exercises are done for thirty-four OECD countries and the Rest of the World (ROW), a sum of all the non-OECD countries. The data describing the stocks and flows of migrants are taken from Docquier et al. (2013). This is the only available data source on migration that provides a detailed description of the skill level of migrants. Due to the fact that this dataset depicts the situation in year 2000, we use the data from this period for all variables. The database gives the reference for the total supply of both low and high skilled labor, as well as the magnitudes of migration shocks divided into those two categories, as presented in Table 7. Therefore, the initial stocks of low/high skilled and domestic/foreign labor force, stocks of migrants in 2000 and changes in the stocks between 1990 and 2000 are taken from the database by Docquier et al. (2013).

The source of the data on GDP and exports is the World Bank Database. We build a measure of the fixed cost of entry using the World Bank - the Doing Business and the World Development Indicators. The calculation of the fixed cost of production, f_i, brings particular troubles since this figure is not directly observable. We propose an unweighted synthetic indicator that incorporates three observable variables that can serve as a proxy for the fixed cost of penetrating the market: the number of days needed to start a business (in line with Di Giovanni et al. (2012)), total cost of a start-up per year of running a company[13] and the share of surviving firms. Then, the synthetic indicator is normalized by the minimum value (achieved by Norway)[14]. Finally, we obtain values in the range $[1; 3.64]$. The tax (t_i) and subsidy (s_i) rates are designed in such a way that the changes in the inequalities in income (before and after the redistribution) fit perfectly the data by Immervoll and Richardson (2011). They calculate the relative changes in the Gini coefficients in the OECD countries before and after imposing the governmental taxes and subsidies.

The starting point of the numerical fit of the model was also chosen on purpose. The initial values of the endogenous variable, TFP, were calibrated using the OECD data on labor productivity. This feature is represented by the GDP per hour worked. Though, these values have no direct impact on the final results of the calibration, they substantially accelerate the convergence of the numerical procedure.

[13]That is the cost of start-up as a percentage of gross national income divided by the average age of a company.

[14]The important things are the relations between fixed costs. Multiplying all the f_i's by a constant decreases the mass of varieties in all countries, but has no impact on the quantitative results.

3.3 Trade Cost Matrix

We derive the implied trade matrix from the estimation of bilateral trade costs, denoted by τ_{ij}. It is well established that impediments to trade play a major role in shaping the trade patterns (see Anderson and VanWincoop (2004)). However, to the best of our knowledge, the following quantitative analysis has always relied on a calibrated parameter for trade barriers. Given their importance to determine the results in this model, we aim at retrieving them from the data. We then estimate them using 2000's bilateral trade flows from the CEPII gravity dataset.[15] This dataset also includes other trade-related data such as the use of the same currency, existence of regional trade agreement (free trade agreement), and sharing common legal system. We augment our estimates by using the geographic data from CEPII Distances dataset including indicators of sharing border, sharing official language, history of colonizing.

We infer trade costs estimating the log-linearized expression of equation (21) which yield the following estimating equation:

$$\begin{aligned} ln(x_{ij}) &= \beta_0 + \lambda_i + \phi_j + \beta_1 ln(Dist) + \beta_2 Border + \beta_3 Legal + \beta_4 Language + \beta_5 Colonial \\ &\quad + \beta_6 CU + \beta_7 FTA + \mu_{ij} \end{aligned} \tag{32}$$

Where λ_i is a fixed effect of the exporting country and ϕ_j is a fixed effect for the importing country. Trade barriers are proxied by standard bilateral variables which affect the volume of exports; geographic distance ($Dist$), common border ($Border$), same legal system ($Legal$), common language ($Language$), colonial ties ($Colonial$), common currency (CU) and free trade agreement (FTA). The standard errors are adjusted for heteroskedasticity. Trade barriers are then computed for each pair. Our sample is composed of the OECD countries and other large trade partners, therefore zero trade flows are negligible in our sample. That prevents our estimation from suffering either from omitted variables bias or selection bias as highlighted by Helpman et al. (2008).
We compute the average trade cost by combining the characteristics described above and their respective coefficients estimates as the following:

$$tradecost = \hat{\beta}_1 ln(dist) + \hat{\beta}_2 Border + \hat{\beta}_3 Legal + \hat{\beta}_4 Language + \hat{\beta}_5 Colonial + \hat{\beta}_6 CU + \hat{\beta}_7 FTA \tag{33}$$

The computed average trade cost is 7.89 which means that the prices of exported varieties are on average 8 times the prices of varieties sold in the country of origin. These values are in line with the recent strand of the literature quantifying trade costs for OECD countries such Irarrazabal et al. (2013). Once, we have estimated trade costs, we build the trade matrix by using equation (29).

3.4 Parameters

We assume the following reference values for the parameters. The elasticity of substitution between varieties of goods, ϵ, was estimated by Feenstra (1994) in the range of [2.96; 8.38]. We take $\epsilon = 4$. The

[15]This dataset does not disentangle trade flows from Belgium and Luxembourg. We then collect the data for those two countries. Trade flows are from the UN Comtrade Statistics Database, RTA from the the WTO web site and data on common legal origins of the two countries are available from Andrei Shleifer's website. Finally, trade flows between Australia and Luxembourg and Turkey and Luxembourg are not reported for the year 2000. As Belgium is the most similar country to Luxembourg, we predict the trade between those countries from Belgian observations.

elasticity of TFP with respect to the ratio of skilled workers to total labor is assumed to be equal to $\lambda = 0.3$. This value is in between the estimates by Acemoglu and Angrist (2000) who find it equal to 0 and Moretti (2004) who estimates $\lambda = 0.75$.

An important improvement in our model in comparison to di Giovanni et al. (2012) is taking the country-specific shares of value added in the production function. Both, the production share of the high skilled, θ_i^H and the corresponding figure for the domestic workers, θ_i^M, are computed using the data about wage ratios between the above mentioned groups (Hendricks (2004) for the high/low skilled and Buchel and Fritsch (2005) for the natives/migrants). Then, using the shares of these groups in the total population of each country we calculate the GDP per capita for every group. After obtaining the relations between the value added of the analyzed groups:

$$r_{h/l} = \frac{GDP^{nh} + GDP^{fh}}{L^{nh} + L^{fh}} \Big/ \frac{GDP^{nl} + GDP^{fl}}{L^{nl} + L^{fl}} \qquad r_{d/f} = \frac{GDP^{nl} + GDP^{nh}}{L^{nl} + L^{nh}} \Big/ \frac{GDP^{fl} + GDP^{fh}}{L^{fl} + L^{fh}},$$

we are able to calculate the firms' parameters of preference towards the two groups for each country i:

$$\theta^H = \frac{r_{h/l}}{1 + r_{h/l}} \qquad \theta^M = \frac{r_{d/f}}{1 + r_{d/f}}.$$

There exist diverse and sometimes conflicting estimates of the elasticities of substitution between low and high skilled, native and foreign workers. Thus, for σ and σ_M we decided to follow Docquier et al. (2013) in setting the middle value of these parameters: $\sigma = 1.75$ and $\sigma_M = 20$.

3.5 The Model Fit

Before starting the quantitative exercise, we assess the quality of the model on the actual macroeconomic data (see Figure 3 and Figure 4 for graphical representation). Using the calculated fixed costs of production and the full labor employment condition (E4), we can easily set the mass of varieties of the final goods available in every country, B_i. The obtained vector is a proxy for the number of enterprises active on a particular market. That is why, a correlation between this figure and the actual number of companies in the analyzed sample of countries, at the level of 0.7473 is very satisfactory. B_i may also be interpreted as an indicator of the market size (being a function of the efficient labor force, $\bar{L}_i^T$), and is highly correlated with the actual population level (0.9806).

The TFP residuals, that are actually calculated from the equilibrium conditions, are not that far away from the labor efficiency measures. The cross-country correlation between our outcomes and actual data is equal to 0.5384. One has to remember that the calculated residual incorporates more than just the technology in a given country. The institutions, infrastructure, legislation, education and social capital, all of these features are certainly influencing the value of A, though they are hard to quantify and measure.

The nominal wages predicted by the model are in line with the actual data. We correlate the wage indexes (which is the proxy for the average levels of wages) with the cross-section average annual wages published by OECD[16]. We obtain a correlation of 0.7975.

A key measure of fit of the above presented model is the implied trade matrix that is constrained by

[16]There were no data for Chile, Iceland, Israel, Mexico, New Zealand, Slovenia and Turkey. We also disregard the ROW composite.

the gravity equations and the trade balance requirements. A plain substitution of the calibrated values of GDPs, price indexes and iceberg trade costs gives the following fit to the actual data. We obtain a correlation of 0.9977 for the matrix of the trade values (see Figure 2) and 0.9481 for the bilateral trade shares[17].

4 The Results of the Simulations

We assess the effect of net migration by imposing two exogenous shocks that consist in sending back migrants to their home countries. First of all, we analyze the general equilibrium effects of the S-N migration (i.e. we withdraw the total stock - immigration and emigration - of migration between the OECD countries and the non-OECD countries). Secondly, we are interested in the consequences of the N-N migration (we relocate the stock of intra-OECD migrants to their home countries). The outcomes are presented in the following manner. In the next subsection we concentrate on the total, macroeconomic effect of the stock of migrants, dividing it into three channels: the market size, wage and TFP effects. Then, we conduct the welfare analysis of the stock of migration by calculating the (price adjusted) gains and losses for each specified type of labor. In the third subsection we concentrate on the comparison between the consequences of migration stock and the migration flow in 1990-2000. Finally, we analyze the inequalities in the countries before and after the shocks, as well as we describe the redistribution policy implications.

4.1 Channels of the Welfare Effect of Migration

The stock of migrants influences almost every equilibrium condition in the analyzed model. The size and composition of the labor force in each country determine the equilibrium wages, the level of production, the long-run level of technology and the number of available varieties. Therefore, the total effect, measured by the change in country's GDP, can be decomposed into three channels: the market size effect, the wage effect and the TFP effect. The market size effect is directly linked to the supply of efficient labor in each country. The larger is the population, the higher is the domestic demand and there are more incentives to create new firms. Because of the love of variety assumption, an increase in the number of available varieties causes the aggregated price index to fall. Due to the international trade, the reaction of the price indexes is interdependent, therefore a drop in the price index in one country is, *ceteris paribus*, beneficial for all its trade partners. Consequently, endogenizing the mass of available products enables to capture positive spillovers from migration. The wage effect is a sum of two equally important elements: the level effect and the composition effect. The level of wages in each country depends on the average productivity of the labor force which is explicitly modeled by the TFP effect. The composition of wages (that is the nominal wages of each group of workers) depends on the shares of these workers in the total labor force. Hence, an increase in the supply of high skilled workers (in ratio to the total labor force) causes a decrease in the relative wage of the well educated people[18]. The TFP effect is measured by

[17]Trade share for a given country i are calculated as ratios between the value of export from country i to another country j divided by the GDP of country i.

[18]Compared to the wage of the low skilled. It is a consequence of (imperfect) substitution between low and high skilled. Naturally, the both wages may be higher then before the shock.

a change in the residual that multiplicatively influences the level of production. The long-run level of productivity of all factors is dependent only on the share of high skilled workers in the population.

4.1.1 The South-North Migration

The general equilibrium effects of the migration shock on the stock of migrants are depicted in Table 2. Let us first consider the South-North (S-N) migration. The impact of these migrants is strongly positive for the OECD countries (the average growth of GDP is 7.1%). On the contrary, the non-OECD countries experience a large drop in their GDP, a decrease by 6.4%. We can observe that the non-OECD migration is extremely beneficial for Israel, Estonia, Australia (20.7%), Canada (19.3%) and New Zealand (14.8%), which are commonly considered as desirable destinations for migration.[19] On the other side, there are Chile (−1.8%), Hungary (−1.3%), Slovakia (−0.8%) and Korea (−0.6%) which encounter a sizable outflow of (high skilled) labor, even to the non-OECD countries. The results confirm the stylized fact that there are only several vertexes in the migration network that gain from the S-N migration. They are in line with the "brain drain" literature in the sense that the highly developed countries with high quality of life are more often chosen as the destination for migration.

Our findings firmly stress the role of the market size effect in the overall welfare analysis. The change in the number of varieties accounts for more than 68% of the absolute change in GDP. Furthermore, we get a very strong correlation between these two effects (the list of winners and losers in terms of market size is the same as before). Moreover, due to the international trade, we observe spillover effects of the domestic market size effect that influence the whole system. These gains (calculated as percentage decreases in the price indexes) are moderately high for the "winners" (a fall in the price index by 3 − 4%), but positive for the "losers" as well (on average the price index decreases by 2.0%). In other words, considering the market size effect when assessing the welfare effect of migration is vital, since the international trade allows to redistribute the gains among all the countries. In line with the main stream of the literature about the welfare impact of migration, we find that the wage effect is also an important channel (it is responsible for nearly 25% of the absolute change in GDP). What is striking, the change in nominal wages is generally negative after the migration shock from the non-OECD countries (though, due to the outliers, the average is 0.4%). This outcome is a composition of two (mainly) opposite effects. On the one hand, the net inflow of people puts a pressure on decreasing the average wages. On the other hand the TFP effect increases the productivity of labor, which pushes the wages upwards. This is to say that the deepening of the labor market provides (apart from negative supply pressure) positive effects in terms of higher long term stock of human capital.

The long-run TFP effect is a sheer consequence of a change in proportion of the high skilled in the population. Therefore, the winners are those who constitute desirable conditions for the best migrants. The largest "brain drain" winners are then Australia (2.3% increase in TFP), New Zealand (1.4%) and the UK (1.2%). The losers are the countries which either attract mainly low skilled people or encounter loss in well educated labor: Austria (−0.9%) or Slovenia (−0.9%). Although the average TFP effect is not substantial (accounts for about 7% of the absolute change in GDP), it plays a critical role in the long-run benefits from migration by enhancing the potential development of new technologies and specialization of entrepreneurs.

[19] Israel and Estonia are in general treated as outliers, that is why we do not consider them in the following analysis.

4.1.2 The North-North Migration

The counter factual exercise of returning the total stock of the intra-OECD migrants to their home countries gives some further insights on the "brain drain" phenomenon. In terms of GDP and the market size we observe huge disproportions between the winners and losers.[20] The GDP of all OECD countries changes, on average, by -2.3%. Australia and Luxembourg gain over 25%, Switzerland over 17% and Canada 11%. At the same time, Ireland and Portugal loose $17-18\%$, Mexico over 15%, Greece, the U.K., Hungary, Poland and Slovakia encounter a drop in GDP by over 10%. The consequences of replacing the stock of OECD migration are devastating for the countries which suffer from a substantial outflow of labor force to the highly developed economies. This, in turn, is directly captured by the market size effect. Furthermore, the international trade cannot mitigate this negative impact completely. The price indexes in the loosing countries rise after the migration shock (on average, the indexes do not move at all).

The wage effect is negative (on average -1.3%), but in the countries which benefit from the "brain drain" the nominal wages actually increase. The highest decline in nominal wages is observed in the countries which loose many high skilled workers (due to the efficiency loss or the composition effect) that is Ireland (-4.3%) and Poland (-3.4%). The same conclusion can be drawn from the TFP effect.

All in all, the N-N migration substantially polarizes the analyzed group of countries. According to the results presented above, migration (the simultaneous effect of immigration and emigration) among the OECD countries raises the GDP in only few countries - the ones which are said to be the most desired destination for (mainly high skilled) migration. The majority of economies, including the Eastern European and the Latin America countries, suffer from a huge decline in GDP due to the outflow of labor force and inability to keep the high skilled workers. The decomposition of the absolute GDP effect convinces that in this case the market size effect dominates and accounts for over 2/3 of the total change. These outcomes are much in line with the "brain drain" literature which concentrates on identifying the winners and losers, as well as quantifying the gains and losses due to migration.

4.2 Welfare Analysis

The next step is to analyze the welfare impact of migration, defined as the ratio of the nominal, net of tax (per capita) wage of every specified group of workers over the price index in a given country.

The results are presented in Table 4. The presence of the stock of non-OECD (S-N) migrants has a strong, positive impact on the overall welfare (2.5% on average in the OECD countries). The workers living in the Rest of the World are suffering from a decline in their real wages by 3.0%. The winners are once again: Australia (7.7%), Canada (6.1%) and New Zealand (5.4%) who benefit from non-OECD migration at the macro level. The welfare of workers in Hungary and Chile is slightly negative. The biggest winners are the countries with high inflow of migrants, substantial increases in GDP, market size and TFP. All in all, the correlation between the change in the above mentioned effects and the change in welfare is higher that 0.95.

The gains for low and high skilled domestic workers are not equally distributed. In fact, in the majority

[20]This simulation was done under two different assumptions. Firstly, we allowed the non-OECD migrants to stay in the OECD countries. Secondly, as a robustness check, we relocated the OECD migrants keeping the situation after the S-N shock. Both simulations give very similar results. We report the results of the former case.

of analyzed countries the low skilled are better off in comparison to the high skilled. This follows from the composition effect of the labor force after the shock. If the group of workers becomes relatively more scarce, then it gains relatively more. Therefore, the low skilled natives who live in countries attracting high skilled migrants from outside the OECD, experience a more sizable increase in nominal and real wages than the high skilled natives. On average, the low skilled gain 3.7% whereas the high skilled 2.4%. The real wages of migrants decrease after the shock due to the substitution effect (−1.5% for the low skilled and −1.8% for the high skilled). Only in the countries which experience a growth in productivity, the wages of migrants increase as well.

Moving to the simulation with the stock of only OECD migrants (N-N) we observe serious disproportions between the source and destination countries. There are literally few winners in terms of the overall welfare. The workers in Australia gain 8.2%, in Canada, Switzerland and Luxembourg: $3-4\%$, people in the U.S., Israel and Sweden are better off by less than 1%. The natives in the rest of the analyzed countries are worse off. As a result, the average change in the real wage of OECD workers is −1.6%. In this simulation, the negative consequences of "brain drain" are clearly visible. The citizens of Ireland, Portugal, Poland and Hungary are the biggest victims of emigration and loose from 5% to 7%. Once again, the main channel through which this process goes on is the market size effect.

Now, in the majority of countries, we have an inverse effect in terms of the relation between the wages of low and high skilled. Because the N-N migration is intensive in high skilled workers, the countries with high outflow of people are the ones where the low skilled are losing (on average −2.5%). On the contrary, the high skilled workers lose on average about 0.2% of their net real wage. Consequently, in more than the half of the OECD countries the high skilled are loosing. Interestingly, in the vast majority of economies the foreign workers (the non-OECD migrants who are assumed to remain) are substantially worse off after the shock (on average −6.4% for the low skilled and −4.8% for the high skilled). The substitution effect between natives and migrants, that operates in favor of the latter group, is now overwhelmed by a drop in country's market size and migrants productivity.

To sum up, we have a clear image of the winners and losers of global migration (see Figure 5). The citizens of countries which are the destinations for migration (especially the high skilled one) are substantially benefiting in all aspects: the real wages, the long-run TFP and the global value of production. The mechanism of "brain drain" gives robust benefits for only several economies (including Australia, Canada, Switzerland, Luxembourg, New Zealand and the U.S.). The rest of the OECD countries are worse off due to a decrease in the size of domestic markets, deterioration of the stock of human capital and a drop in productivity, which has a direct impact on the real wage of citizens. However, the losses are mitigated by a spillover effect of the market size, which operates thanks to the international trade.

4.3 Stock versus Flow of Migrants

In another simulation we consider only the flow of migrants that arrived between 1990 and 2000 (see Table 3). These workers, in comparison to the migrants who moved long time ago, are not that assimilated with the natives. Furthermore, the patterns of migration change dramatically in the 1990s. Countries like Ireland, Austria or Great Britain became the new destinations for emigrants (especially from Eastern Europe). The bilateral flows between Mexico and the U.S. or New Zealand and Australia increased its importance. Therefore, the image of winners and losers of the flow of non-OECD and OECD migration is slightly different than in the case of stock of migrants.

The flow of non-OECD migrants has a positive market size effect (average increase of the mass of varieties by 1.6% and decrease in the price index by −0.8%). Now the U.K., Ireland, Austria and Iceland gained a lot in terms of the market size. The long-run the TFP increased in Australia, Canada and New Zealand by about 0.6%, just like in the case of stocks. However, we observe a robust jump in the long-run TFP in the U.K. (1.0%), Iceland (1.0%) and Ireland (0.4%). All these countries encountered the most substantial gains in terms of the nominal wage. The overall gain in GDP is positive, equal to 1.8%.

After imposing the intra-OECD migration shock (N-N), we arrive at surprising results. The average change of the market size is −0.2% whereas the overall GDP falls by 0.5%. This weak effect may be a consequence of outliers: Mexico −8.1% in market size and −9.8% in GDP and Portugal −5.4% in market size and −8.0% in GDP. The biggest winners in terms of GDP are Luxembourg (9.6%), Ireland (6.1%) and Austria (5.5%), whereas the former winners like Canada or New Zealand experience a drop in their GDP. An interesting examples of benefiting from migration are Luxembourg and Ireland. Those two countries have a negative long run TFP (especially Ireland with −2.7%). However, due to a massive market size effect (8.6% for Luxembourg and 7.5% for Ireland) they managed to increase the total value of production. What is striking, the former winner, New Zealand, looses from the flow of migration: −5.3% in market size and −8.0% in GDP. This is, of course, due to high emigration to Australia.

The citizens of the majority of countries are better off due to the S-N migration (see Table 5). The average change in the real wage is equal to 1.0%. The winners are Canada (2.8%), New Zealand (2.6%), Australia, Ireland and the U.K. (all 2.00%). The losers are Poland (−0.3%), Chile and Hungary (both −0.20%). Once again, the low skilled natives are on average better off after imposing the non-OECD migration shock. They gain 1.7%, compared to 0.7% for the high skilled natives.

The N-N migration brings substantial benefits for the citizens of Australia, Austria, Switzerland, Israel and Luxembourg (all above 1% gain in terms of the overall change in welfare). On the other side of the coin we have New Zealand with the change in the overall net real wage at the level of −4.1%, Portugal −4.0% and Mexico −3.5%. Symmetrically to what we have seen in the simulation of stock of migrants, here the high skilled natives are relatively better off (no change in welfare on average) then the low skilled (−0.6%).

The analysis of the flow of migrants gives us two stories about the migration in 1990s. Some economies which were severely hit by the outflow of workers in the second half of the XX century (Ireland, the U.K. or Austria) managed to rebuild the labor force in the 1990s and became the winners in terms of total GDP and welfare of the natives. Other countries suffering from large emigration (like Portugal, Poland, Mexico or Slovakia) are still the victims of the "brain drain". New Zealand, which was always perceived as a demanded target country for migration, in the 1990s saw the occurrence of a reverse situation. The better life perspectives in Australia reinforced emigration which made the citizens of New Zealand worse off.

4.4 Inequalities Due to Migration and Redistribution

In the public debate about the benefits and costs of migration, it is often argued that migration increases the inequalities in the society. The underlying story concentrates mainly on the consequences of an inflow of low skilled workers, who enlarge the mass of the left tail of the distribution of wages which increases its dispersion. In this section we would like to address the question of inequalities caused by both S-N and N-N migration. We present the consequences of a redistribution policy which aims at keeping the national distribution of income constant after a migration shock.

Our measure of inequalities in the society boils down to a simple Gini coefficient calculated upon four groups of workers. What we are interested in, is the ratio between the coefficient before and after the redistribution. Notice that we do not consider the total distribution of incomes of the society, only the averages among four groups of workers. However, the relative change in the value of this measure gives some insights into the evolution of disproportions after imposing the migration shocks. The very same datum was determined by Immervoll and Richardson (2011) who quantitatively set the impact of the governmental redistribution policy on inequality (measured by the Gini coefficient). Therefore, the second measure that we determine is the redistribution rate between the high skilled and the low skilled, set by the government. Having the data about the Gini coefficient before and after the redistribution (using the calculations by Immervoll and Richardson (2011)), we are able to fit the lump-sum transfer from the high skilled to the low skilled (we express this number as a percentage of the real income of the high skilled).

The Table 6 presents the results for all the simulations. For the majority of the analyzed countries, the non-OECD (S-N) migration (both the stock and the flow) slightly increases the inequalities among the citizens. The inverse relation between the change in the share of high skilled and the change in the inequality measure is corroborated (correlation at the level of -0.68 for the stock and -0.94 for the flow). Thus, if the share of high skilled increases (which means that the country is the "brain drain" beneficent), then the inequalities in the society should decrease[21]. In the other direction, an inflow of low skilled labor increases the disproportions among the analyzed groups. Notice, that the final change in the inequalities is brought about by two factors: the change in the specific share of labor in the population and the change in the relative nominal wages. The larger relative number of low skilled increases the wage of the high skilled which reinforces the increase in inequalities. These facts support the hypothesis of the negative impact of migration on inequalities in the majority of countries.

Considering the OECD migration, the above described pattern does not hold so robustly. Now, roughly all the OECD countries encounter an increase in the Gini coefficient due to either increase or decrease in the share of high skilled workers[22]. Such a mechanism mainly depends on the relative wage effect. In some countries, the victims of "brain drain", the relative share of high skilled decreases, but simultaneously their wage increases substantially in relation to the low skilled. This in turn causes the inequalities to increase. The countries with a positive "brain drain" effect (stock for Australia, Canada, New Zealand, the U.S.) experience an increase in their Gini coefficient as well, due to a sharp drop in the relative nominal wages of the low skilled (see Figure 6). Therefore, the negative inequality effect of the N-N migration in the long run is caused by a significant wage effect which is mainly beneficial for the high skilled. Thus, the problem of increasing inequalities is a consequence of an outflow of the high skilled, an explanation different from the S-N migration. What is more, the impact of non-OECD migrants on inequalities is small (an average increase of 0.56% of the Gini coefficient for the stock and -0.27% for the flow) in comparison to the OECD migration. The latter causes an average rise in Gini by 3.05% for the stock and 0.41% for the flow.

[21] This is the case in 2 OECD countries for stock and 7 for flow.

[22] On the contrary, the effects of the flow of OECD migrants were similar to the stock of non-OECD migrants.

Finally, the consequences of increasing inequalities can be diminished by an appropriate redistribution policy. In order to keep the transfer to the low skilled constant, one has to change the lump-sum tax imposed on the high skilled by the government. Thus, for the stock of non-OECD migrants the average ratio between the tax and the real wage of high skilled has to decrease by 0.95% whereas for the stock of N-N migrants the growth of this measure has to equal to 2.04%. The values for the flow of migrants are -0.77% and 0.42% respectively. Therefore, concluding from the general equilibrium effects of the model, one can state that what is really driving the inequalities up and keeping the costs of migration high is the "brain drain" among the OECD countries, the relative loss of high skilled workers and the insurmountable increase in the dispersion of nominal wages. Consequently, in order to mitigate these negative effects, the authorities should impose policies which aim at increasing the number of high skilled workers through labor market liberalization or by stimulating education. In the long run the stock of human capital available in the economy plays a crucial role.

5 Robustness check

The magnitudes of the simulated effects are strongly dependent on the parametrization assumed in the model. It is then necessary to check the quantitative sensitivity of the presented results to several key parameters. As a reminder, we recall their benchmark values in Table 1.

Table 1: The Benchmark Parametrisation of the Model

Description of the parameter	Symbol	Default value
Elasticity of substitution between varieties	ϵ	3
Elasticity of TFP w.r.t the ratio of skilled workers to total labor	λ	0.3
Elasticity of substitution between high and low skilled workers	σ	1.75
Elasticity of substitution between natives and migrants	σ_M	20

In Table 8, in each group of columns we show the percent changes in key variables (the averages across 34 OECD countries and the standard deviations in the paranthesis) after imposing a migration shock on the stock of migrants (either S-N or N-N). Each of these groups consists of three results, in the left (right) column we assume low (high) values of the analyzed elasticity (keeping everything else as in the benchmark scenario, which is reported in the middle column).

We see that the elasticity of substitution between varieties has no impact on the change in the number of varieties (B), TFP (A), wage differential (w^{nh}/w^{nl}) and the Gini coefficient. On the contrary, higher ϵ spurs a more beneficial GDP effect (a consequence of stronger price effect on P) and a higher nominal wage effect (W). Higher elasticity in the TFP function, λ, increases the variation of the TFP level, which raises the GDP and the nominal wages. The latter has a slight impact on price indexes. The numbers of varieties, wage differentials and Gini coefficients are, once again, not affected.

An increase in the elasticity of substitution between high and low skilled workers produces negative consequences for the changes in GDP (due to the fact that the effective labor aggregate is adversely influenced). Simultaneously, the change in the number of varieties decreases, as B is a linear function of $\bar{L}^T$. Higher σ diminishes the wage gaps between high and low skilled workers, and slightly changes the wage composites. The former has a major impact on the Gini coefficient, whereas the latter has a minor influence on the price indexes. A drop in the elasticity of substitution between natives and migrants increases the benefits of migration. The changes in GDP and B are then more positive after imposing a migration shock. The labor market is somewhat affected, which has an impact on the price levels and inequalities. The changes in both elasticities from the production function: σ and σ_M, have no direct consequence on the TFP variations.

6 Conclusions

The main objective of the paper is to calculate the welfare impact of migration in the OECD countries. We construct a simple general equilibrium model with trade in which we are able to decompose the general effect into three main channels: the wage effect, the TFP effect and the market size effect.

Our model estimates that the non-OECD migrants increase the total GDP of the OECD countries by more than 4.8%, although the average increase of natives welfare is 0.9%. Simultaneously, the aggregated value of production in the Rest of the World diminishes by over 6%. In terms of the stock of all migrants, there is only a group of countries that strongly benefit from migration. Economies like Australia, Canada or Switzerland have always been considered as demanded destinations for the migrants. Our results confirm that the natives in these countries are the biggest winners of the global migration flows (gains of 15.8%, 9.2%, 6.9% respectively). Considering only the North-North migration, we observe huge disproportions among the OECD countries in terms of the overall welfare impact (from +8.2% for Australia to −7.0% for Ireland, on average −1.6%). Therefore, it is the intra-OECD migration that creates differences in welfare in the developed world. Furthermore, low and high skilled workers are not equally better off after the migration shocks. In the South-North migration shock, the low skilled are winning due to the fact that the (registered) migration from the non-OECD countries is intensive in high skilled labor. Considering the North-North exercise, the situation is reversed and in the majority of countries the high skilled are the winners. This is the consequence of larger outflow of high skilled workers to the "brain drain" destinations.

Secondly, we underline the importance of the market size effect, which is in line with the results by di Giovanni et al. (2012). In our model, the effect of the size of the domestic market accounted for more than 68% of the overall welfare impact of migration. Although the wage effect is robustly important in the overall welfare consequences of migration (responsible for over 24% of the magnitude), we argue that an analysis of migration effects considering only the wage effect would be incomplete.

Thirdly, the multi-country model allowed us to draw conclusions about the impact of trade on the distribution of the benefits from migration. We argue that this effect is observable and can equalize the gains from migration among the countries. In particular, the spillovers of the national market size effects reduce the price levels in all the OECD countries, not only in those with a net inflow of workers. These positive externalities, brought about by international trade, have to be the subject of further theoretical and empirical inquiries, especially in the context of substitution or complementarity of trade and migration.

Finally, we draw conclusions about the inequalities caused by migration in the destination countries. According to the common belief, migration increases the inequalities due to an inflow of poor, low skilled workers from the non-OECD economies to the developed countries. We confirm this statement in our simulations, however the quantitative importance of this process is not that high. The main cause of increasing inequalities is the intra-OECD migration. The mechanism here is simple, and depends on the loss of high skilled labor, which spurs a rapid increase in the relative wages of the high skilled. Therefore, a way to diminish the negative consequences of migration in the drained economies is to rebuild the stock of high skilled workers by preventing them from emigration, giving incentives for potential high skilled immigrants or by improving the education standards in the country.

Acknowledgments

The authors are grateful to Frédéric Docquier for many invaluable comments and suggestions.
Michał Burzyński would like to thank the Polish Ministry of Higher Education and Science, for the financial support of the Mobility Plus scholarship.

References

1. Acemoglu, D. & Angrist, J. (2001). How large are human-capital externalities? Evidence from compulsory-schooling laws. In NBER Macroeconomics Annual 2000, Volume 15 (pp. 9-74). MIT Press.

2. Anderson, J. & van Wincoop, E. (2004). "Trade Costs," Journal of Economic Literature, American Economic Association, volume 42(3) (pp. 691-751), September.

3. Barro, R. J., & Lee, J. W. (2012). A new data set of educational attainment in the world, 1950–2010. Journal of Development Economics.

4. Benhabib, J., & Jovanovic, B. (2012). Optimal migration: a world perspective. International Economic Review, 53(2), 321-348.

5. Borjas, G. J. (2009). The analytics of the wage effect of immigration (No. w14796). National Bureau of Economic Research.

6. Borjas, G. J., Grogger, J., & Hanson, G. H. (2008). Imperfect substitution between immigrants and natives: a reappraisal (No. w13887). National Bureau of Economic Research.

7. Broda, C. & Weinstein, D. E. (2006). Globalization and the Gains from Variety. The Quarterly Journal of Economics, 121(2), 541-585.

8. Di Giovanni, J., & Levchenko, A. A. (2010). Firm entry, trade, and welfare in Zipf's world (No. w16313). National Bureau of Economic Research.

9. Di Giovanni, J., Levchenko, A. A., & Ortega, F. (2012). A global view of cross-border migration (No. 6584). Discussion Paper series, Forschungsinstitut zur Zukunft der Arbeit.

10. Dixit, A. K. & Stiglitz, J. E. (1977). Monopolistic competition and optimum product diversity. The American Economic Review, 67(3), 297-308.

11. Docquier, F., Ozden, C., Parsons, C., & Artuc, E. (2012). A Global Assessment of Human Capital Mobility: the Role of non-OECD Destinations (No. 2012022). Université catholique de Louvain, Institut de Recherches Economiques et Sociales (IRES).

12. Docquier, F., Ozden, C., & Peri, G. (2013). The labor market effects of immigration and emigration in OECD countries. The Economic Journal, available online, in press.

13. Docquier, F. & Rapoport, H. (2012). Globalization, brain drain, and development. Journal of Economic Literature, 50(3), 681-730.

14. Feenstra, R. C. (1994). New product varieties and the measurement of international prices. The American Economic Review, 157-177.

15. Grossman, G. & Helpman, E. (1989). Product Development and International Trade, Journal of Political Economy, 97, issue 6, p. 1261-83.

16. Head, K. & Mayer, T., (2013). "Gravity Equations: Workhorse, Toolkit, and Cookbook," CEPR Discussion Papers 9322, C.E.P.R. Discussion Papers.

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

18. Hendricks, L. (2004). Why does educational attainment differ across US states?.

19. Iranzo, S., & Peri, G. (2009). Migration and trade: Theory with an application to the Eastern–Western European integration. Journal of International Economics, 79(1), 1-19.

20. Irarrazabal A., Moxnes A., & Opromolla L. D. (2013). The Tip of the Iceberg: A Quantitative Framework for Estimating Trade Costs. NBER Working Papers 19236, National Bureau of Economic Research, Inc.

21. Krugman, P. R. (1979). Increasing returns, monopolistic competition, and international trade. Journal of international Economics, 9(4), 469-479.

22. Krugman, P. (1980). Scale economies, product differentiation, and the pattern of trade. The American Economic Review, 70(5), 950-959.

23. Melitz, M. J. (2003). The impact of trade on intraindustry reallocations and aggregate industry productivity. Econometrica, 71(6), 1695-1725.

24. Ortega, F., & Peri, G. (2012). The effect of trade and migration on income (No. w18193). National Bureau of Economic Research.

25. Ottaviano, G. I., & Peri, G. (2012). Rethinking the effect of immigration on wages. Journal of the European Economic Association, 10(1), 152-197.

26. Özden, C., Parsons, C. R., Schiff, M., & Walmsley, T. L. (2011). Where on earth is everybody? The evolution of global bilateral migration 1960–2000. The World Bank Economic Review, 25(1), 12-56.

27. Peri, G., Shih, K. & Sparber, C. (2013). STEM Workers, H1B Visas and Productivity in US Cities. Norface Discussion Paper Series 2013009, Norface Research Program on Migration, Department of Economics, University College London.

28. Spence, A. M. (1976). Product Selection, Fixed Costs, and Monopolistic Competition. Rev. Econ. Stud., 43, 217-35.

29. United Nations, Department of Economic and Social Affairs (2013). Trends in International Migrant Stock: Migrants by Destination and Origin (United Nations database, POP/DB/MIG/Stock/Rev.2013).

Table 2: The Macroeconomic Effects of the Stocks of Migrants

Code	Stock of migrants, S-N					Stock of migrants, N-N					Total effect				
	GDP	B	P	W	A	GDP	B	P	W	A	GDP	B	P	W	A
AUS	20.7	16.8	-4.1	3.3	2.3	28.9	24.5	-4.2	3.6	0.6	49.6	41.3	-8.3	6.9	2.9
AUT	3.9	4.9	-1.7	-1.0	-0.9	-5.2	-2.6	0.8	-2.6	-2.5	-1.3	2.3	-0.9	-3.6	-3.5
BEL	3.4	3.9	-1.6	-0.5	-0.1	2.9	3.8	-0.6	-0.8	-1.4	6.3	7.6	-2.2	-1.3	-1.6
CAN	19.3	16.9	-3.9	2.0	0.8	11.0	9.7	-1.8	1.2	0.0	30.3	26.6	-5.7	3.2	0.8
CHE	7.4	7.3	-2.2	0.2	0.1	17.2	15.3	-2.7	1.7	-0.2	24.7	22.6	-4.9	1.9	-0.1
CHL	-1.8	-0.7	-0.8	-1.1	-0.1	-4.8	-3.2	0.7	-1.6	-1.2	-6.6	-3.9	-0.1	-2.7	-1.3
CZE	0.7	1.3	-1.2	-0.6	0.1	-1.5	0.3	0.1	-1.8	-2.1	-0.8	1.7	-1.0	-2.4	-2.0
DEU	1.4	2.0	-1.3	-0.6	0.0	-1.1	0.0	0.1	-1.1	-1.1	0.3	2.0	-1.2	-1.6	-1.1
DNK	1.1	2.1	-1.2	-0.9	-0.4	-4.3	-2.8	0.6	-1.5	-1.2	-3.1	-0.7	-0.6	-2.4	-1.6
ESP	4.3	4.2	-1.7	0.1	0.4	-0.4	-0.2	0.0	-0.3	-0.1	3.9	4.1	-1.8	-0.2	0.3
EST	39.2	32.2	-5.7	5.3	3.2	-8.4	-6.4	1.2	-2.1	-1.4	30.8	25.8	-4.5	3.2	1.9
FIN	0.0	0.8	-1.1	-0.9	-0.1	-6.3	-5.4	0.9	-0.9	-0.1	-6.3	-4.6	-0.1	-1.8	-0.2
FRA	2.9	3.5	-1.5	-0.6	-0.3	0.3	1.1	-0.2	-0.8	-0.9	3.2	4.6	-1.7	-1.4	-1.2
GBR	8.3	7.1	-2.3	1.1	1.2	-10.0	-7.0	1.6	-3.3	-2.5	-1.7	0.1	-0.7	-2.2	-1.3
GRC	4.0	4.5	-1.7	-0.4	-0.2	-10.8	-8.8	1.8	-2.3	-1.1	-6.8	-4.3	0.1	-2.7	-1.2
HUN	-1.3	-0.2	-0.9	-1.1	-0.2	-10.4	-7.1	1.7	-3.6	-2.9	-11.7	-7.4	0.8	-4.6	-3.1
IRL	3.8	3.6	-1.6	0.2	0.7	-16.9	-13.2	2.9	-4.3	-2.6	-13.1	-9.7	1.3	-4.0	-1.9
ISL	5.9	5.2	-2.0	0.7	1.1	-8.9	-6.4	1.3	-2.6	-2.0	-3.0	-1.3	-0.6	-1.9	-0.9
ISR	63.1	45.2	-8.6	12.3	8.9	4.2	4.5	-0.8	-0.3	-0.9	67.4	49.8	-9.4	12.0	8.0
ITA	1.2	1.8	-1.2	-0.6	0.1	-8.3	-6.4	1.3	-2.0	-1.1	-7.1	-4.6	0.1	-2.6	-1.1
JPN	-0.2	0.6	-1.0	-0.8	0.0	-0.3	0.0	-0.1	-0.3	-0.2	-0.6	0.5	-1.1	-1.1	-0.2
KOR	-0.6	0.2	-0.9	-0.8	0.0	-6.8	-5.1	1.0	-1.8	-1.1	-7.4	-4.9	0.1	-2.6	-1.1
LUX	3.3	4.0	-1.6	-0.7	-0.4	26.3	25.4	-3.5	0.7	-2.3	29.6	29.4	-5.0	0.0	-2.7
MEX	-0.4	0.3	-1.0	-0.8	0.1	-15.1	-12.7	2.6	-2.8	-1.0	-15.6	-12.3	1.7	-3.6	-0.9
NLD	10.0	9.9	-2.6	0.2	-0.3	0.7	1.8	-0.2	-1.1	-1.4	10.7	11.6	-2.8	-0.9	-1.7
NOR	2.7	3.2	-1.5	-0.5	-0.1	0.0	0.3	-0.1	-0.2	-0.2	2.7	3.4	-1.6	-0.7	-0.2
NZL	14.8	12.6	-3.2	2.0	1.4	0.8	1.7	-0.3	-0.9	-1.2	15.6	14.3	-3.5	1.1	0.2
POL	1.8	2.4	-1.3	-0.6	0.0	-11.5	-7.8	1.9	-4.1	-3.4	-9.8	-5.4	0.6	-4.7	-3.4
PRT	-0.2	0.4	-1.0	-0.6	0.2	-18.5	-15.6	3.3	-3.4	-1.2	-18.6	-15.1	2.2	-4.0	-0.9
SVK	-0.8	0.1	-1.0	-0.8	0.0	-13.3	-10.7	2.1	-2.8	-1.5	-14.0	-10.7	1.1	-3.7	-1.5
SVN	8.8	9.3	-2.3	-0.5	-0.9	-9.6	-7.7	1.5	-2.1	-1.2	-0.9	1.6	-0.9	-2.6	-2.1
SWE	4.5	4.7	-1.8	-0.3	0.0	3.1	3.5	-0.6	-0.4	-0.9	7.5	8.2	-2.4	-0.6	-0.9
TUR	2.5	2.7	-1.4	-0.1	0.4	-5.0	-4.5	0.7	-0.5	0.3	-2.5	-1.9	-0.7	-0.7	0.7
USA	6.4	6.4	-2.0	0.0	0.0	5.1	5.1	-1.0	0.0	-0.7	11.5	11.5	-3.0	0.0	-0.7
OECD	7.1	6.4	-2.0	0.4	0.5	-2.3	-1.1	0.4	-1.3	-1.2	4.8	5.4	-1.7	-0.9	-0.7
ROW	-6.4	-3.5	0.1	-3.0	-1.9	-0.1	0.0	-0.1	-0.1	0.0	-6.5	-3.5	0.0	-3.1	-1.9

For all the countries we present three packages of results. The set "Stock of migrants, S-N" shows the percent changes in main variables after imposing an exogenous migration shock on the stock of non-OECD migrants. "Stock of migrants, N-N" gathers the results after an exogenous migration shock on the stock of OECD migrants. "Total effect" is the sum of the two former shocks. We present the percent change in Gross Domestic Product (GDP), the number of varieties (B), the price index (P), the wage index (W) and the TFP level (A). OECD stands for the average for all the OECD countries, ROW stands for the Rest of the World, that is all the non-OECD countries.

Table 3: The Macroeconomic Effects of the Flows of Migrants

Code	Flow of migrants, S-N					Flow of migrants, N-N					Total effect				
	GDP	B	P	W	A	GDP	B	P	W	A	GDP	B	P	W	A
AUS	5.1	4.3	-1.3	0.7	0.7	2.4	1.0	-0.4	1.3	1.4	7.5	5.4	-1.7	2.1	2.1
AUT	3.3	3.5	-1.1	-0.2	-0.2	5.5	5.0	-0.9	0.5	-0.2	8.9	8.5	-1.9	0.3	-0.5
BEL	1.5	1.7	-0.8	-0.2	0.1	0.6	0.5	-0.1	0.1	0.0	2.1	2.2	-0.9	-0.1	0.0
CAN	7.7	6.6	-1.7	1.0	0.6	-0.5	-0.6	0.1	0.0	0.1	7.1	6.0	-1.6	1.0	0.7
CHE	3.2	3.0	-1.0	0.2	0.3	1.6	0.2	-0.3	1.4	1.6	4.8	3.2	-1.3	1.6	1.9
CHL	-0.9	-0.4	-0.4	-0.5	0.0	-1.4	-1.0	0.2	-0.5	-0.4	-2.3	-1.3	-0.1	-1.0	-0.4
CZE	0.1	0.3	-0.6	-0.2	0.2	1.2	0.5	-0.2	0.7	0.7	1.3	0.8	-0.7	0.5	1.0
DEU	0.5	0.7	-0.6	-0.3	0.1	1.1	1.1	-0.2	0.0	-0.2	1.6	1.8	-0.8	-0.3	-0.1
DNK	0.9	1.3	-0.7	-0.4	-0.2	-0.2	0.1	0.0	-0.2	-0.3	0.8	1.4	-0.6	-0.6	-0.4
ESP	2.5	2.4	-0.9	0.1	0.2	0.8	1.0	-0.1	-0.2	-0.4	3.3	3.4	-1.0	-0.1	-0.2
EST	-22.9	-19.4	3.3	-4.3	-1.6	-4.3	-3.1	0.6	-1.2	-1.0	-27.2	-22.5	4.0	-5.5	-2.6
FIN	0.3	0.7	-0.6	-0.4	0.0	0.1	0.5	0.0	-0.4	-0.6	0.4	1.2	-0.6	-0.8	-0.6
FRA	0.9	1.0	-0.7	-0.1	0.2	-0.3	-0.4	0.1	0.1	0.2	0.6	0.6	-0.6	0.0	0.4
GBR	4.1	3.1	-1.2	0.9	1.0	-0.3	-0.1	0.1	-0.2	-0.2	3.7	3.0	-1.1	0.7	0.8
GRC	-0.6	-0.1	-0.4	-0.5	-0.1	-1.5	-0.8	0.3	-0.8	-0.8	-2.1	-0.8	-0.2	-1.3	-0.9
HUN	-0.9	-0.3	-0.4	-0.6	-0.1	0.0	0.0	0.0	0.0	0.0	-0.9	-0.3	-0.4	-0.6	-0.2
IRL	5.8	5.1	-1.4	0.6	0.4	6.1	7.5	-0.9	-1.3	-2.7	11.9	12.7	-2.4	-0.7	-2.3
ISL	3.8	3.1	-1.1	0.8	1.0	0.9	0.2	-0.1	0.7	0.8	4.8	3.3	-1.2	1.5	1.7
ISR	29.7	17.5	-4.6	10.4	9.9	1.0	-0.1	-0.2	1.1	1.3	30.7	17.4	-4.8	11.5	11.2
ITA	0.4	0.8	-0.6	-0.3	0.0	-0.8	-0.3	0.1	-0.6	-0.6	-0.4	0.5	-0.4	-0.9	-0.6
JPN	0.0	0.4	-0.5	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	-0.5	-0.4	0.0
KOR	-0.5	-0.1	-0.4	-0.4	0.0	-3.0	-2.1	0.5	-0.9	-0.7	-3.5	-2.2	0.1	-1.3	-0.7
LUX	2.1	2.5	-0.9	-0.4	-0.3	9.6	8.6	-1.3	0.9	-0.1	11.7	11.1	-2.2	0.6	-0.4
MEX	-0.3	0.1	-0.5	-0.4	0.0	-9.8	-8.1	1.7	-1.9	-0.8	-10.2	-8.1	1.3	-2.3	-0.8
NLD	2.0	2.0	-0.8	0.0	0.2	0.6	0.4	-0.1	0.2	0.1	2.6	2.4	-0.9	0.2	0.4
NOR	1.6	1.8	-0.8	-0.2	0.0	1.8	1.5	-0.3	0.3	0.1	3.3	3.3	-1.1	0.1	0.1
NZL	7.0	6.0	-1.6	0.9	0.7	-8.0	-5.3	1.4	-2.8	-2.5	-1.0	0.7	-0.2	-1.9	-1.8
POL	-1.6	-1.0	-0.3	-0.6	0.0	-3.6	-2.1	0.6	-1.5	-1.4	-5.2	-3.1	0.3	-2.1	-1.5
PRT	1.2	1.4	-0.7	-0.2	0.0	-8.0	-5.4	1.4	-2.7	-2.2	-6.8	-4.0	0.6	-2.9	-2.2
SVK	0.0	0.3	-0.5	-0.3	0.1	-3.5	-2.0	0.5	-1.4	-1.4	-3.4	-1.7	0.0	-1.8	-1.4
SVN	-0.1	0.1	-0.5	-0.1	0.3	-5.3	-4.3	0.8	-1.1	-0.7	-5.4	-4.2	0.3	-1.3	-0.3
SWE	2.8	2.7	-1.0	0.1	0.2	-0.4	-0.6	0.1	0.1	0.2	2.4	2.2	-0.9	0.3	0.5
TUR	0.9	0.9	-0.7	0.0	0.4	-1.0	-1.0	0.2	0.0	0.2	-0.1	-0.1	-0.5	0.0	0.5
USA	2.8	2.8	-1.0	0.0	0.1	1.6	1.6	-0.2	0.0	-0.3	4.3	4.3	-1.2	0.0	-0.2
OECD	1.8	1.6	-0.8	0.1	0.4	-0.5	-0.2	0.1	-0.3	-0.3	1.3	1.4	-0.7	-0.2	0.1
ROW	-3.1	-1.6	0.0	-1.5	-1.0	0.0	0.0	0.0	0.0	0.0	-3.1	-1.6	0.0	-1.5	-1.0

For all the countries we present three packages of results. The set "Flow of migrants, S-N" shows the percent changes in main variables after imposing an exogenous migration shock on the flow of non-OECD migrants between years 1990-2000. "Flow of migrants, N-N" gathers the results after an exogenous migration shock on the flow of OECD migrants in 1990-2000. "Total effect" is the sum of the two former shocks. We present the percent change in Gross Domestic Product (GDP), the number of varieties (B), the price index (P), the wage index (W) and the TFP level (A). OECD stands for the average for all the OECD countries, ROW stands for the Rest of the World, that is all the non-OECD countries.

Table 4: The Welfare Effects of the Stocks of Migrants

Code	Stock of migrants, S-N					Stock of migrants, N-N					Total effect				
	$\bar{L}$	L^{nl}	L^{nh}	L^{fl}	L^{fh}	$\bar{L}$	L^{nl}	L^{nh}	L^{fl}	L^{fh}	$\bar{L}$	L^{nl}	L^{nh}	L^{fl}	L^{fh}
AUS	7.7	12.2	5.8	10.0	2.6	8.2	10.2	9.0	4.0	4.6	15.8	22.4	14.8	14.0	7.2
AUT	0.7	-0.1	1.4	-3.3	-0.7	-3.4	-5.9	-1.6	-9.6	-7.7	-2.7	-6.1	-0.2	-12.9	-8.3
BEL	1.1	1.2	1.5	-0.6	-1.1	-0.3	-1.7	1.4	-7.6	-3.4	0.9	-0.4	2.9	-8.2	-4.5
CAN	6.1	9.0	5.6	5.4	1.4	3.1	3.8	3.9	0.0	0.5	9.2	12.8	9.4	5.4	1.9
CHE	2.4	2.9	2.8	1.1	1.2	4.5	5.2	6.1	-1.3	-1.6	6.9	8.1	8.9	-0.2	-0.4
CHL	-0.3	-0.4	-0.2	-7.3	-3.9	-2.3	-3.4	-1.0	-4.8	-4.4	-2.6	-3.9	-1.2	-12.1	-8.4
CZE	0.6	0.7	0.6	-0.3	-1.4	-2.0	-3.3	0.1	-11.0	-5.8	-1.4	-2.6	0.7	-11.4	-7.2
DEU	0.7	0.9	0.8	-0.8	-2.0	-1.1	-2.1	0.2	-8.3	-4.2	-0.4	-1.3	1.0	-9.1	-6.2
DNK	0.3	0.2	0.8	-3.2	-1.6	-2.1	-3.2	-0.7	-6.7	-5.8	-1.8	-3.1	0.1	-9.9	-7.4
ESP	1.8	2.6	1.7	-2.8	-2.6	-0.2	-0.1	0.1	-2.3	-2.8	1.6	2.4	1.8	-5.2	-5.5
EST	11.6	17.7	11.2	-7.2	-9.5	-3.2	-4.6	-1.7	-4.9	-2.6	8.4	13.1	9.5	-12.2	-12.2
FIN	0.2	0.2	0.4	-2.1	-1.4	-1.9	-1.9	-1.7	-7.0	-7.8	-1.6	-1.7	-1.3	-9.1	-9.2
FRA	0.9	0.8	1.3	-2.4	-2.7	-0.6	-1.4	0.3	-5.1	-2.8	0.3	-0.6	1.6	-7.5	-5.6
GBR	3.5	5.3	3.2	0.0	-1.3	-4.8	-7.6	-2.5	-9.8	-6.2	-1.3	-2.3	0.7	-9.9	-7.5
GRC	1.3	1.4	1.8	-9.4	-5.1	-4.0	-4.9	-2.9	-5.8	-5.0	-2.7	-3.5	-1.1	-15.2	-10.1
HUN	-0.2	-0.4	-0.1	-2.8	-2.3	-5.1	-7.7	-3.1	-12.2	-8.7	-5.4	-8.1	-3.1	-15.0	-10.9
IRL	1.9	3.2	1.8	2.5	0.7	-7.0	-8.0	-4.7	-18.0	-14.7	-5.1	-4.8	-2.9	-15.5	-14.0
ISL	2.7	3.8	2.2	1.1	0.1	-3.9	-6.0	-0.7	-10.5	-7.4	-1.2	-2.2	1.5	-9.4	-7.2
ISR	22.9	39.9	17.0	27.4	7.5	0.5	-0.2	2.4	-1.5	0.4	23.4	39.7	19.4	25.8	8.0
ITA	0.7	0.8	0.8	-7.6	-3.5	-3.3	-4.4	-2.4	-5.6	-5.6	-2.6	-3.6	-1.7	-13.2	-9.1
JPN	0.2	0.2	0.2	-3.4	-3.2	-0.2	-0.4	0.0	-3.7	-3.4	0.0	-0.2	0.2	-7.0	-6.6
KOR	0.1	0.1	0.1	-10.7	-3.7	-2.8	-4.2	-1.7	-4.8	-5.0	-2.7	-4.1	-1.6	-15.5	-8.8
LUX	0.9	0.6	1.5	-0.2	0.9	4.3	3.3	8.5	-7.0	-3.3	5.2	3.9	10.0	-7.2	-2.4
MEX	0.2	0.3	0.1	-1.7	-2.0	-5.3	-6.0	-4.3	-11.6	-10.2	-5.1	-5.7	-4.3	-13.3	-12.2
NLD	2.8	2.9	3.7	-1.1	0.1	-0.8	-1.8	1.1	-5.0	-3.0	2.0	1.1	4.7	-6.1	-2.9
NOR	1.0	1.1	1.2	-2.3	-0.8	-0.1	-0.1	0.4	-3.7	-5.3	0.9	1.0	1.7	-6.0	-6.1
NZL	5.4	7.7	4.5	4.9	2.1	-0.7	-0.7	1.8	-5.5	-4.9	4.7	7.1	6.3	-0.6	-2.8
POL	0.8	0.9	0.9	-6.5	-8.1	-5.9	-8.7	-3.1	-10.0	-4.8	-5.1	-7.8	-2.2	-16.5	-12.8
PRT	0.4	0.9	0.5	-7.3	-3.4	-6.5	-7.6	-5.9	-9.2	-9.8	-6.0	-6.7	-5.4	-16.6	-13.2
SVK	0.1	0.1	0.1	-1.6	-1.5	-4.8	-5.9	-3.6	-12.0	-10.4	-4.7	-5.8	-3.5	-13.5	-11.8
SVN	1.9	1.5	3.2	-10.9	-6.5	-3.6	-4.6	-2.5	-5.4	-3.9	-1.7	-3.2	0.7	-16.3	-10.4
SWE	1.5	1.8	1.8	-0.8	-1.1	0.2	-0.4	1.5	-5.1	-2.9	1.7	1.3	3.3	-5.8	-4.0
TUR	1.3	1.9	0.9	-6.0	-4.2	-1.3	-0.9	-1.6	-2.3	-4.0	0.1	1.1	-0.6	-8.2	-8.2
USA	2.1	2.5	2.4	-0.5	-2.4	1.0	-0.2	2.1	-4.2	-0.4	3.0	2.3	4.5	-4.7	-2.8
OECD	2.5	3.7	2.4	-1.5	-1.8	-1.6	-2.5	-0.2	-6.4	-4.8	0.9	1.1	2.2	-7.9	-6.5
ROW	-3.0	-4.6	-1.5	N/A	N/A	0.0	0.0	0.0	0.0	0.0	-3.0	-4.6	-1.5	0.0	0.0

For all the countries we present three packages of results. The set "Stock of migrants, S-N" shows the percent changes in welfare (real wages) after imposing an exogenous migration shock on the stock of non-OECD migrants. "Stock of migrants, N-N" gathers the results after an exogenous migration shock on the stock of OECD migrants. "Total effect" is the sum of the two former shocks. We present the percent change in the real remunerations of: total efficient labor composite ($\bar{L}^T$), native low-skilled workers (L^{nl}), native high-skilled workers (L^{nh}), foreign low-skilled workers (L^{fl}), foreign high-skilled workers (L^{fh}). OECD stands for the average for all the OECD countries, ROW stands for the Rest of the World, that is all the non-OECD countries.

Table 5: The Welfare Effects of the Flows of Migrants

Code	Flow of migrants, S-N					Flow of migrants, N-N					Total effect				
	$\bar{L}$	L^{nl}	L^{nh}	L^{fl}	L^{fh}	$\bar{L}$	L^{nl}	L^{nh}	L^{fl}	L^{fh}	$\bar{L}$	L^{nl}	L^{nh}	L^{fl}	L^{fh}
AUS	2.1	3.4	1.6	2.9	0.8	1.7	4.1	0.2	4.6	-0.7	3.8	7.5	1.8	7.5	0.1
AUT	0.9	0.8	1.2	-0.7	-0.3	1.3	1.3	1.8	-0.6	-1.6	2.2	2.1	3.0	-1.4	-1.9
BEL	0.6	0.8	0.7	0.2	-0.6	0.2	0.2	0.3	0.2	-1.4	0.8	1.0	0.9	0.4	-2.0
CAN	2.8	4.6	2.0	3.8	0.4	-0.1	0.3	-0.3	0.8	-0.6	2.7	4.9	1.7	4.6	-0.2
CHE	1.2	1.7	1.2	1.1	0.6	1.7	3.6	0.5	4.2	-1.0	2.9	5.3	1.7	5.3	-0.4
CHL	-0.2	-0.2	-0.1	-2.1	-1.9	-0.7	-1.1	-0.3	-1.1	-1.6	-0.9	-1.3	-0.4	-3.3	-3.6
CZE	0.4	0.6	0.2	0.6	-0.6	0.9	1.5	0.3	1.5	-3.2	1.2	2.1	0.5	2.1	-3.8
DEU	0.3	0.5	0.3	0.0	-0.9	0.2	0.0	0.5	-1.0	-1.0	0.5	0.4	0.8	-1.0	-1.9
DNK	0.3	0.2	0.5	-1.5	-1.1	-0.3	-0.6	0.1	-1.0	-1.4	0.0	-0.4	0.6	-2.4	-2.4
ESP	1.0	1.4	1.0	-0.7	-1.1	-0.1	-0.4	0.3	-1.3	-1.1	0.9	1.0	1.3	-2.0	-2.3
EST	-7.4	-9.7	-7.0	-7.1	-5.2	-1.8	-2.8	-0.7	-3.0	-1.3	-9.2	-12.5	-7.7	-10.0	-6.5
FIN	0.2	0.2	0.3	-1.4	-1.2	-0.4	-1.1	0.3	-3.3	-3.4	-0.2	-0.9	0.5	-4.8	-4.6
FRA	0.5	0.8	0.5	0.4	-1.0	0.1	0.3	0.0	0.6	-1.1	0.6	1.0	0.5	1.0	-2.1
GBR	2.1	3.5	1.5	2.9	-0.4	-0.3	-0.5	0.1	-0.2	-1.5	1.8	3.0	1.7	2.7	-1.9
GRC	-0.1	-0.2	0.0	-0.4	-0.2	-1.0	-1.8	-0.3	-1.8	-0.5	-1.1	-2.0	-0.3	-2.1	-0.6
HUN	-0.2	-0.3	-0.1	0.1	-0.5	0.0	0.0	0.0	0.6	-0.6	-0.2	-0.4	-0.1	0.7	-1.1
IRL	2.1	3.0	2.0	2.4	1.1	-0.4	-2.2	1.6	-3.6	-3.2	1.7	0.7	3.6	-1.2	-2.1
ISL	1.9	2.8	1.4	1.7	0.1	0.8	1.4	0.7	0.7	-1.3	2.7	4.2	2.1	2.4	-1.3
ISR	15.8	31.0	7.8	29.9	3.0	1.3	3.1	0.4	3.3	-0.4	17.0	34.0	8.2	33.2	2.6
ITA	0.3	0.3	0.3	-1.8	-1.1	-0.7	-1.4	-0.3	-1.7	-1.3	-0.4	-1.0	0.1	-3.5	-2.4
JPN	0.1	0.2	0.2	-1.9	-2.0	0.0	0.0	0.0	-0.1	-0.8	0.1	0.2	0.2	-2.0	-2.8
KOR	0.0	0.0	0.0	0.3	-0.6	-1.4	-2.3	-0.7	-2.2	-1.0	-1.4	-2.3	-0.7	-1.9	-1.6
LUX	0.5	0.2	0.9	-0.2	0.6	2.3	2.7	2.9	1.5	0.3	2.8	2.9	3.9	1.3	0.8
MEX	0.0	0.1	0.0	0.1	-0.7	-3.5	-4.2	-2.7	-4.7	-4.7	-3.5	-4.1	-2.7	-4.7	-5.5
NLD	0.9	1.2	0.8	0.8	-0.1	0.3	0.5	0.2	0.5	-0.8	1.1	1.7	1.0	1.3	-0.9
NOR	0.6	0.6	0.7	-1.0	-0.3	0.6	0.7	0.6	0.4	-1.0	1.2	1.4	1.3	-0.6	-1.4
NZL	2.6	3.7	2.2	2.5	1.2	-4.1	-6.8	-1.2	-7.2	-2.0	-1.5	-3.1	1.0	-4.6	-0.8
POL	-0.3	-0.4	-0.4	1.0	0.4	-2.1	-3.4	-1.0	-2.9	-1.1	-2.4	-3.8	-1.3	-2.0	-0.8
PRT	0.5	0.7	0.6	-3.6	-1.9	-4.0	-6.4	-2.9	-6.9	-4.8	-3.5	-5.8	-2.3	-10.5	-6.7
SVK	0.2	0.3	0.2	-0.7	-1.0	-2.0	-3.0	-0.7	-5.7	-5.0	-1.7	-2.8	-0.6	-6.4	-6.0
SVN	0.4	0.7	0.1	0.8	-0.2	-1.9	-2.6	-1.4	-2.7	-1.8	-1.6	-1.9	-1.2	-1.9	-2.0
SWE	1.1	1.5	1.0	0.4	-0.7	0.1	0.3	-0.1	0.6	-1.0	1.2	1.7	1.0	1.0	-1.8
TUR	0.7	1.1	0.2	0.6	-1.8	-0.2	0.1	-0.4	-0.4	-2.1	0.5	1.2	-0.1	0.3	-3.9
USA	1.0	1.2	1.0	0.2	-0.7	0.2	-0.2	0.6	-1.2	0.1	1.2	1.0	1.7	-1.0	-0.6
OECD	1.0	1.7	0.7	0.9	-0.5	-0.4	-0.6	0.0	-1.0	-1.6	0.6	1.0	0.6	-0.1	-2.1
ROW	-1.5	-2.3	-0.7	-3.4	-3.5	0.0	0.0	0.0	0.0	0.0	-1.5	-2.3	-0.7	-3.4	-3.5

For all the countries we present three packages of results. The set "Flow of migrants, S-N" shows the percent changes in welfare (real wages) after imposing an exogenous migration shock on the flow of non-OECD migrants between years 1990-2000. "Flow of migrants, N-N" gathers the results after an exogenous migration shock on the flow of OECD migrants in 1990-2000. "Total effect" is the sum of the two former shocks. We present the percent change in the real remunerations of: total efficient labor composite ($\bar{L}^T$), native low-skilled workers (L^{nl}), native high-skilled workers (L^{nh}), foreign low-skilled workers (L^{fl}), foreign high-skilled workers (L^{fh}). OECD stands for the average for all the OECD countries, ROW stands for the Rest of the World, that is all the non-OECD countries.

Table 6: The Effects of Migrants on Inequalities and Tax

Code	Stock, S-N		Stock, N-N		Flow, S-N		Flow, N-N	
	Gini	Tax	Gini	Tax	Gini	Tax	Gini	Tax
AUS	-4.43	-5.22	3.58	-1.15	-1.79	-1.62	-4.00	-3.50
AUT	-0.45	1.59	-0.43	4.32	-0.24	0.40	-0.22	0.36
BEL	0.69	0.22	4.84	3.05	0.05	-0.15	0.37	-0.09
CAN	3.38	-2.70	12.93	-0.06	-2.83	-2.14	-0.89	-0.64
CHE	-0.25	-0.12	0.12	0.32	-0.17	-0.42	-0.35	-2.87
CHL	0.21	0.21	0.56	2.14	0.09	0.09	0.17	0.68
CZE	0.40	-0.22	1.12	3.47	0.15	-0.44	0.56	-1.35
DEU	0.98	-0.08	5.32	2.16	0.16	-0.15	1.16	0.42
DNK	2.62	0.56	4.09	2.23	1.43	0.24	0.73	0.58
ESP	1.19	-0.76	0.62	0.09	0.58	-0.41	0.26	0.54
EST	4.94	-6.07	1.35	2.42	2.03	2.69	0.92	1.70
FIN	0.38	0.16	0.76	0.16	0.27	0.08	1.41	1.12
FRA	2.07	0.43	2.99	1.63	0.07	-0.30	-0.46	-0.34
GBR	0.18	-2.05	1.37	4.47	-0.16	-1.87	0.17	0.30
GRC	2.27	0.39	0.73	1.72	0.08	0.17	0.20	1.32
HUN	0.10	0.36	-0.46	4.89	-0.05	0.19	-0.03	0.01
IRL	1.19	-1.66	14.49	2.49	1.04	-1.12	6.66	2.86
ISL	1.07	-1.45	2.46	4.33	0.29	-1.34	-0.02	-0.88
ISR	-13.94	-14.79	1.22	1.83	-14.02	-16.69	-2.75	-2.68
ITA	0.52	-0.10	-0.21	1.68	0.19	-0.03	-0.16	0.92
JPN	0.31	-0.02	0.61	0.38	0.20	-0.02	0.08	0.01
KOR	0.27	0.04	1.82	2.09	0.01	-0.01	1.08	1.36
LUX	0.72	0.87	6.63	4.70	0.57	0.65	-0.08	0.04
MEX	0.22	-0.23	0.37	1.33	0.06	-0.09	0.08	1.15
NLD	1.69	0.65	3.34	2.50	-0.10	-0.47	0.07	-0.39
NOR	-0.24	0.13	-0.09	0.29	-0.15	0.04	-0.17	-0.19
NZL	0.48	-2.80	11.70	1.16	-0.06	-1.33	6.64	4.75
POL	1.11	-0.02	-0.66	5.66	-0.24	0.00	-0.50	2.33
PRT	0.97	-0.44	-0.16	1.65	0.57	-0.10	-1.00	3.49
SVK	0.19	-0.02	0.21	2.32	0.14	-0.12	0.03	2.26
SVN	0.89	1.69	0.09	1.94	0.02	-0.55	0.04	1.08
SWE	2.33	0.02	6.64	1.71	0.41	-0.41	-1.10	-0.41
TUR	1.59	-0.92	0.66	-0.64	0.51	-0.80	0.39	-0.47
USA	5.42	-0.06	15.03	1.89	1.63	-0.17	4.81	0.71
OECD	0.56	-0.95	3.05	2.04	-0.27	-0.77	0.41	0.42
ROW	-1.34	3.02	0.00	0.00	-0.77	1.51	0.00	0.00

For all the countries we present four packages of results. The set "Stock, S-N" shows the percent changes in the Gini coefficient and the tax rate after imposing an exogenous migration shock on the stock of non-OECD migrants. "Stock, N-N" gathers the results after an exogenous migration shock on the stock of OECD migrants. "Flow, S-N" and "Flow, N-N" present the results after a migration shock on the flow of non-OECD and OECD migrants respectively in years 1990-2000. OECD stands for the average for all the OECD countries, ROW stands for the Rest of the World, that is all the non-OECD countries.

Table 7: The Structure of the Labor Force

Code	Benchmark					Stock of S-N migrants					Stock of N-N migrants					Flow of S-N migrants					Flow of N-N migrants				
	Total L^T	Share L^{nl}	Share L^{nh}	Share L^{fl}	Share L^{fh}	Total L^T	Share L^{nl}	Share L^{nh}	Share L^{fl}	Share L^{fh}	Total L^T	Share L^{nl}	Share L^{nh}	Share L^{fl}	Share L^{fh}	Total L^T	Share L^{nl}	Share L^{nh}	Share L^{fl}	Share L^{fh}	Total L^T	Share L^{nl}	Share L^{nh}	Share L^{fl}	Share L^{fh}
AUS	12.41	0.51	0.21	0.15	0.13	11.11	0.56	0.24	0.12	0.08	10.47	0.61	0.26	0.06	0.07	12.04	0.52	0.22	0.15	0.11	12.46	0.50	0.22	0.17	0.11
AUT	5.81	0.73	0.13	0.12	0.02	5.46	0.78	0.14	0.07	0.01	5.75	0.78	0.15	0.06	0.01	5.59	0.77	0.13	0.09	0.01	5.52	0.76	0.14	0.09	0.01
BEL	7.26	0.63	0.25	0.10	0.02	7.01	0.65	0.26	0.07	0.02	6.96	0.68	0.28	0.03	0.01	7.16	0.64	0.25	0.09	0.02	7.24	0.62	0.26	0.10	0.02
CAN	20.70	0.40	0.38	0.09	0.13	18.28	0.45	0.43	0.05	0.07	19.38	0.43	0.44	0.05	0.08	19.68	0.42	0.40	0.08	0.10	20.82	0.38	0.39	0.10	0.13
CHE	5.09	0.65	0.12	0.18	0.05	4.76	0.69	0.13	0.14	0.04	4.45	0.76	0.16	0.06	0.02	4.96	0.66	0.12	0.17	0.05	5.20	0.64	0.12	0.20	0.04
CHL	8.64	0.84	0.16	0.00	0.00	8.70	0.84	0.16	0.00	0.00	8.81	0.84	0.16	0.00	0.00	8.67	0.84	0.16	0.00	0.00	8.68	0.84	0.16	0.00	0.00
CZE	7.02	0.84	0.10	0.05	0.01	6.95	0.86	0.10	0.04	0.00	6.91	0.88	0.11	0.01	0.00	7.02	0.84	0.10	0.05	0.01	7.04	0.85	0.10	0.05	0.00
DEU	60.33	0.68	0.24	0.06	0.02	59.07	0.71	0.24	0.04	0.01	59.50	0.71	0.26	0.02	0.01	59.88	0.69	0.24	0.06	0.01	59.47	0.70	0.24	0.05	0.01
DNK	3.74	0.73	0.21	0.05	0.01	3.64	0.75	0.21	0.03	0.01	3.79	0.76	0.22	0.02	0.00	3.68	0.74	0.21	0.04	0.01	3.72	0.73	0.21	0.05	0.01
ESP	28.82	0.84	0.11	0.04	0.01	28.08	0.86	0.12	0.02	0.00	28.98	0.84	0.12	0.03	0.01	28.36	0.85	0.11	0.03	0.01	28.46	0.83	0.12	0.04	0.01
EST	0.92	0.63	0.12	0.17	0.08	0.76	0.82	0.18	0.00	0.00	0.97	0.64	0.13	0.16	0.07	1.11	0.53	0.11	0.26	0.10	0.94	0.62	0.13	0.17	0.08
FIN	3.58	0.71	0.26	0.02	0.01	3.55	0.73	0.26	0.01	0.00	3.79	0.73	0.26	0.01	0.00	3.56	0.73	0.26	0.01	0.00	3.54	0.72	0.27	0.01	0.00
FRA	40.55	0.70	0.20	0.08	0.02	38.90	0.74	0.21	0.04	0.01	39.53	0.73	0.22	0.04	0.01	40.17	0.71	0.21	0.07	0.01	40.82	0.70	0.21	0.08	0.01
GBR	40.35	0.76	0.15	0.06	0.03	38.53	0.81	0.16	0.02	0.01	42.02	0.76	0.18	0.04	0.02	39.77	0.78	0.15	0.05	0.02	40.30	0.76	0.16	0.06	0.02
GRC	7.72	0.80	0.14	0.05	0.01	7.46	0.84	0.15	0.01	0.00	8.39	0.80	0.15	0.04	0.01	7.72	0.80	0.14	0.05	0.01	7.71	0.79	0.15	0.05	0.01
HUN	6.99	0.87	0.12	0.01	0.00	6.99	0.88	0.12	0.00	0.00	7.28	0.87	0.13	0.00	0.00	7.00	0.87	0.12	0.01	0.00	6.99	0.87	0.12	0.01	0.00
IRL	2.32	0.73	0.15	0.07	0.05	2.28	0.75	0.15	0.06	0.04	2.77	0.78	0.20	0.01	0.01	2.24	0.75	0.15	0.06	0.04	2.15	0.74	0.19	0.05	0.02
ISL	0.17	0.75	0.12	0.09	0.04	0.17	0.79	0.13	0.05	0.03	0.18	0.80	0.16	0.03	0.01	0.17	0.78	0.12	0.07	0.03	0.17	0.78	0.12	0.07	0.03
ISR	3.32	0.42	0.13	0.30	0.15	2.58	0.70	0.18	0.08	0.04	3.16	0.46	0.16	0.25	0.13	3.16	0.49	0.14	0.30	0.07	3.38	0.40	0.14	0.32	0.14
ITA	42.78	0.90	0.08	0.02	0.00	42.28	0.91	0.09	0.00	0.00	44.95	0.90	0.09	0.01	0.00	42.56	0.91	0.08	0.01	0.00	42.50	0.89	0.09	0.02	0.00
JPN	92.34	0.75	0.24	0.01	0.00	91.97	0.76	0.24	0.00	0.00	92.29	0.76	0.24	0.00	0.00	92.05	0.76	0.24	0.00	0.00	92.31	0.75	0.24	0.01	0.00
KOR	29.37	0.74	0.26	0.00	0.00	29.34	0.74	0.26	0.00	0.00	30.56	0.73	0.27	0.00	0.00	29.41	0.74	0.26	0.00	0.00	29.75	0.74	0.26	0.00	0.00
LUX	0.30	0.47	0.20	0.26	0.07	0.29	0.49	0.21	0.23	0.07	0.24	0.66	0.29	0.04	0.01	0.29	0.48	0.21	0.24	0.07	0.28	0.50	0.23	0.22	0.05
MEX	46.20	0.89	0.11	0.00	0.00	46.18	0.89	0.11	0.00	0.00	52.46	0.88	0.12	0.00	0.00	46.21	0.89	0.11	0.00	0.00	49.87	0.89	0.11	0.00	0.00
NLD	11.11	0.65	0.18	0.13	0.04	10.19	0.72	0.20	0.06	0.02	10.88	0.70	0.21	0.07	0.02	10.94	0.66	0.19	0.12	0.03	11.10	0.65	0.19	0.13	0.03
NOR	3.06	0.73	0.20	0.05	0.02	2.97	0.76	0.20	0.03	0.01	3.05	0.75	0.21	0.03	0.01	3.01	0.74	0.20	0.04	0.02	3.02	0.73	0.20	0.05	0.02
NZL	2.43	0.62	0.17	0.12	0.09	2.24	0.67	0.19	0.08	0.06	2.48	0.68	0.24	0.05	0.03	2.33	0.64	0.18	0.10	0.08	2.53	0.61	0.19	0.11	0.09
POL	24.66	0.86	0.11	0.03	0.00	24.22	0.88	0.11	0.01	0.00	25.75	0.86	0.12	0.02	0.00	24.87	0.86	0.11	0.03	0.00	24.77	0.86	0.11	0.03	0.00
PRT	7.08	0.90	0.08	0.02	0.00	7.12	0.91	0.09	0.00	0.00	8.25	0.90	0.09	0.01	0.00	7.02	0.90	0.09	0.01	0.00	7.21	0.89	0.09	0.02	0.00
SVK	3.43	0.89	0.11	0.00	0.00	3.43	0.89	0.11	0.00	0.00	3.79	0.88	0.12	0.00	0.00	3.42	0.89	0.11	0.00	0.00	3.45	0.88	0.12	0.00	0.00
SVN	1.37	0.76	0.13	0.10	0.01	1.25	0.84	0.15	0.01	0.00	1.46	0.76	0.14	0.09	0.01	1.38	0.76	0.13	0.10	0.01	1.42	0.76	0.13	0.10	0.01
SWE	6.22	0.64	0.24	0.09	0.03	5.92	0.66	0.26	0.06	0.02	5.95	0.68	0.27	0.04	0.01	6.05	0.66	0.25	0.07	0.02	6.27	0.62	0.25	0.10	0.03
TUR	33.70	0.90	0.08	0.02	0.00	33.29	0.92	0.08	0.00	0.00	35.55	0.91	0.08	0.01	0.00	33.64	0.91	0.08	0.01	0.00	34.2	0.91	0.08	0.01	0.00
USA	183.75	0.41	0.45	0.08	0.06	171.47	0.44	0.49	0.05	0.02	172.79	0.43	0.49	0.04	0.04	178.22	0.43	0.47	0.06	0.04	180.23	0.42	0.47	0.06	0.05
ROW	2426.19	0.94	0.06	0.00	0.00	2453.28	0.94	0.06	0.00	0.00	2426.19	0.94	0.06	0.00	0.00	2436.40	0.94	0.06	0.00	0.00	2426.19	0.94	0.06	0.00	0.00

Source: Docquier et al. (2013). For all the countries we present five packages of data. The set "Benchmark" shows the reference demographic structure of countries. "Stock of S-N migrants" ("Stock of N-N migrants") presents the structure of labor after imposing an exogenous migration shock on the stock of non-OECD (OECD) migrants. "Flow of S-N migrants" ("Flow of N-N migrants") presents the structure of labor after imposing an exogenous migration shock on the flow of non-OECD (OECD) migrants in years 1990-2000. The table contains the following variables: Total labor supply (Total L^T) in millions of people, the share of low-skilled natives (Share L^{nl}) in percent, the share of high-skilled natives (Share L^{nh}) in percent, the share of low-skilled foreigners (Share L^{fl}) in percent, the share of high-skilled foreigners (Share L^{fh}) in percent. ROW stands for the Rest of the World, that is the sum for all the non-OECD countries.

Table 8: Robustness Check of the Results of Simulations

ϵ	GDP			B			P			W			A			w^{nh}/w^{nl}			Gini		
S-N	6.8	7.1	10.1	6.4	6.4	6.4	-2.8	-2.0	1.3	0.2	0.4	3.3	0.5	0.5	0.5	-1.1	-1.1	-1.1	0.6	0.6	0.6
	(12.4)	(12.8)	(12.3)	(9.4)	(9.4)	(9.4)	(1.7)	(1.6)	(2.8)	(2.3)	(2.5)	(2.8)	(1.7)	(1.7)	(1.7)	(3.6)	(3.6)	(3.6)	(3.0)	(3.0)	(3.0)
N-N	-2.5	-2.3	-0.6	-1.1	-1.1	-1.1	0.2	0.4	2.0	-1.6	-1.3	0.4	-1.2	-1.2	-1.2	2.9	2.9	2.9	3.0	3.0	3.0
	(10.7)	(10.8)	(10.4)	(9.3)	(9.3)	(9.3)	(2.0)	(1.7)	(2.9)	(1.7)	(1.7)	(2.6)	(0.9)	(0.9)	(0.9)	(2.2)	(2.2)	(2.2)	(4.4)	(4.4)	(4.4)

λ	GDP			B			P			W			A			w^{nh}/w^{nl}			Gini		
S-N	6.9	7.1	7.3	6.4	6.4	6.4	-2.0	-2.0	-2.0	0.2	0.4	0.5	0.3	0.5	0.7	-1.1	-1.1	-1.1	0.6	0.6	0.6
	(12.1)	(12.8)	(13.4)	(9.4)	(9.4)	(9.4)	(1.5)	(1.6)	(1.6)	(2.0)	(2.5)	(3.0)	(1.1)	(1.7)	(2.3)	(3.6)	(3.6)	(3.6)	(3.0)	(3.0)	(3.0)
N-N	-2.3	-2.3	-2.5	-1.1	-1.1	-1.1	0.0	0.4	0.5	-1.3	-1.3	-1.6	-0.8	-1.2	-1.6	2.9	2.9	2.9	3.0	3.0	3.0
	(10.7)	(10.8)	(10.9)	(9.3)	(9.3)	(9.3)	(1.6)	(1.7)	(1.7)	(1.5)	(1.7)	(1.9)	(0.6)	(0.9)	(1.2)	(2.2)	(2.2)	(2.2)	(4.4)	(4.4)	(4.4)

σ	GDP			B			P			W			A			w^{nh}/w^{nl}			Gini		
S-N	7.2	7.1	7.0	6.5	6.4	6.4	-2.0	-2.0	-2.0	0.4	0.4	0.4	0.5	0.5	0.5	-1.3	-1.1	-1.0	0.2	0.6	0.9
	(13.1)	(12.8)	(12.5)	(9.7)	(9.4)	(9.3)	(1.6)	(1.6)	(1.5)	(2.5)	(2.5)	(2.5)	(1.7)	(1.7)	(1.7)	(4.2)	(3.6)	(3.2)	(3.4)	(3.0)	(2.9)
N-N	-2.5	-2.3	-2.3	-1.2	-1.1	-1.0	0.3	0.4	0.2	-1.5	-1.3	-1.5	-1.2	-1.2	-1.2	3.3	2.9	2.5	3.3	3.0	2.8
	(10.8)	(10.8)	(10.7)	(9.3)	(9.3)	(9.2)	(1.7)	(1.7)	(1.6)	(1.7)	(1.7)	(1.7)	(0.9)	(0.9)	(0.9)	(2.6)	(2.2)	(1.9)	(4.4)	(4.4)	(4.5)

σ_M	GDP			B			P			W			A			w^{nh}/w^{nl}			Gini		
S-N	7.8	7.1	6.3	6.7	6.4	6.2	-1.6	-2.0	-2.4	0.9	0.4	-0.1	0.5	0.5	0.5	-1.1	-1.1	-1.2	0.6	0.6	0.2
	(13.1)	(12.8)	(12.4)	(9.6)	(9.4)	(9.2)	(1.6)	(1.6)	(1.5)	(2.5)	(2.5)	(2.5)	(1.7)	(1.7)	(1.7)	(3.6)	(3.6)	(3.7)	(3.2)	(3.0)	(2.4)
N-N	-1.7	-2.3	-3.1	-0.9	-1.1	-1.3	2.7	0.4	-0.2	-1.0	-1.3	-1.9	-1.2	-1.2	-1.2	2.9	2.9	2.8	2.9	3.0	2.3
	(11.0)	(10.8)	(10.6)	(9.4)	(9.3)	(9.1)	(1.7)	(1.7)	(1.6)	(1.7)	(1.7)	(1.7)	(0.9)	(0.9)	(0.9)	(2.2)	(2.2)	(2.2)	(4.1)	(4.4)	(3.0)

The robustness check is done for four parameters: the elasticity of substitution between varieties: ϵ, the elasticity of TFP with respect to the ratio of skilled workers to total labor: λ, the elasticity of substitution between high and low skilled workers: σ, and the elasticity of substitution between natives and migrants: σ_M. In each group of columns we show the percent changes in key variables (the averages across 34 OECD countries and the standard deviation in the paranthesis below) after imposing a migration shock on the stock of migrants (either S-N or N-N). Each of these groups consists of three results, in the left (right) hand side column we assume low (high) values of the analyzed elasticity (keeping everything else as in the benchmark scenario, which is reported in the middle column).
The values of the elasticities are as follows: $\epsilon \in \{3, 4, 5\}$, $\lambda \in \{0.2, 0.3, 0.4\}$, $\sigma \in \{1.5, 1.75, 2\}$, $\sigma_M \in \{15, 20, 30\}$.

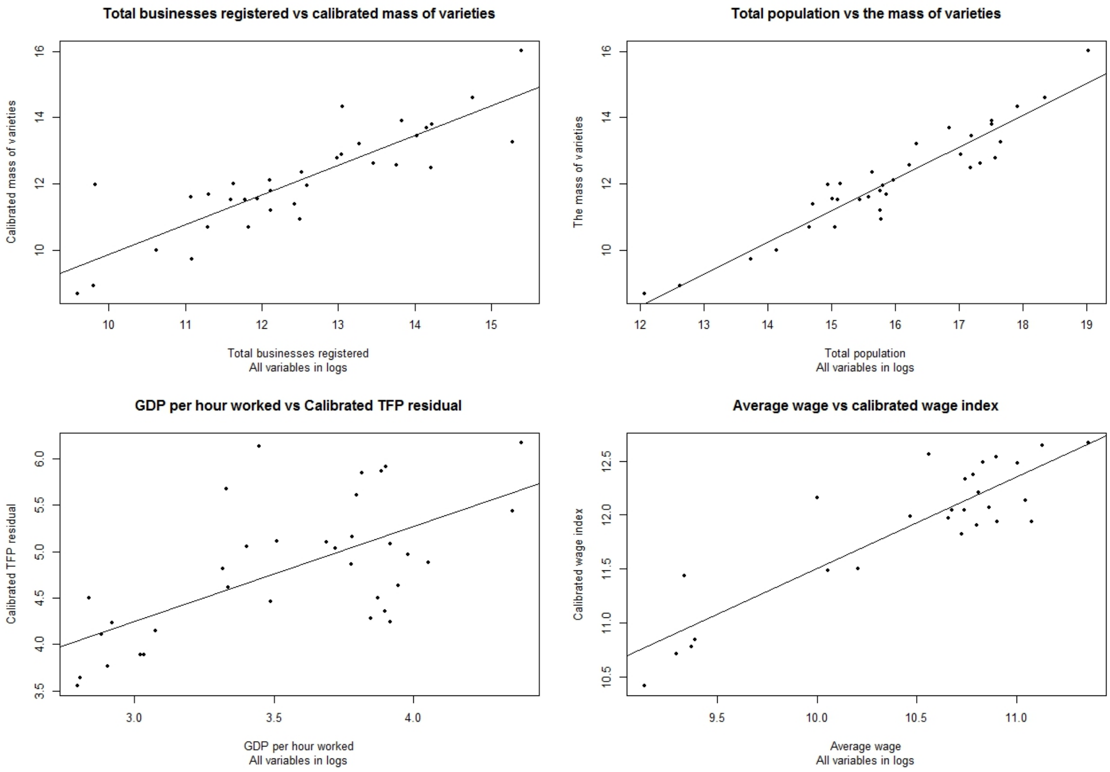

Figure 1: The matching of the model: calibrated variables and their real counterparties

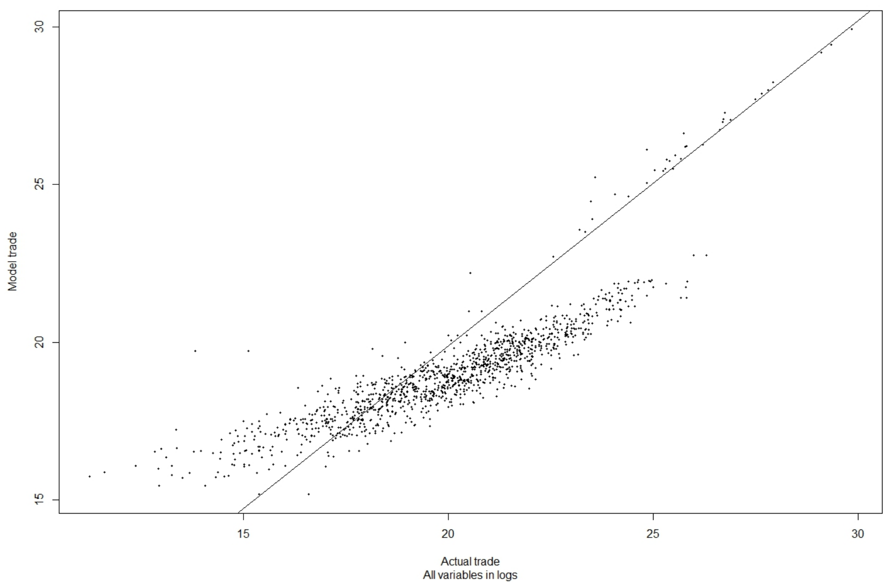

Figure 2: The matching of the model: calculated trade flows and the real trade flows, in log

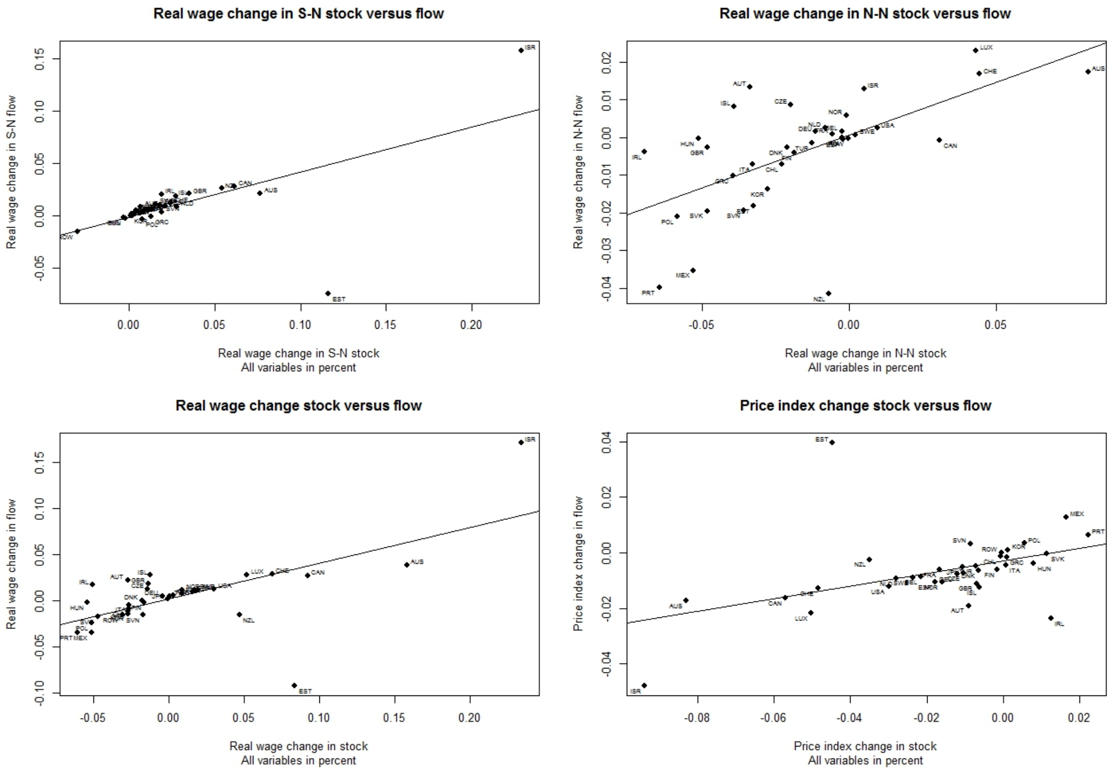

Figure 3: Comparison of the results of simulations: real wages and price indexes

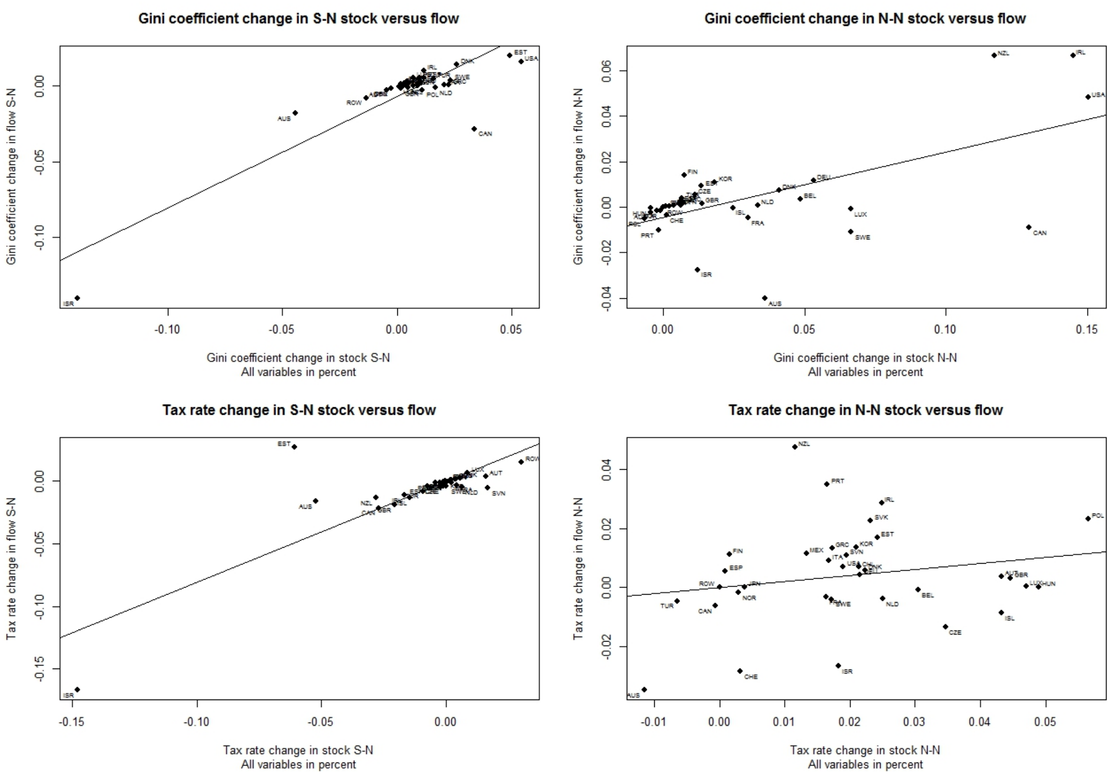

Figure 4: Comparison of the results of simulations: Gini coefficients and tax rates

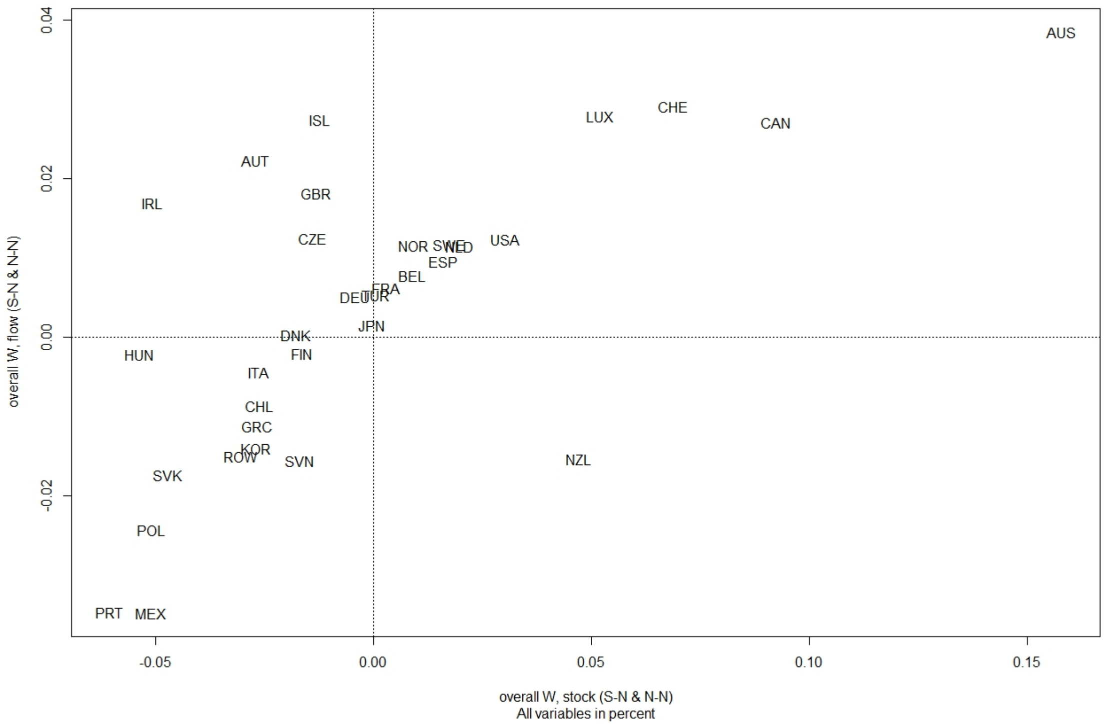

Figure 5: The overall welfare gains of migration in stock and flow.

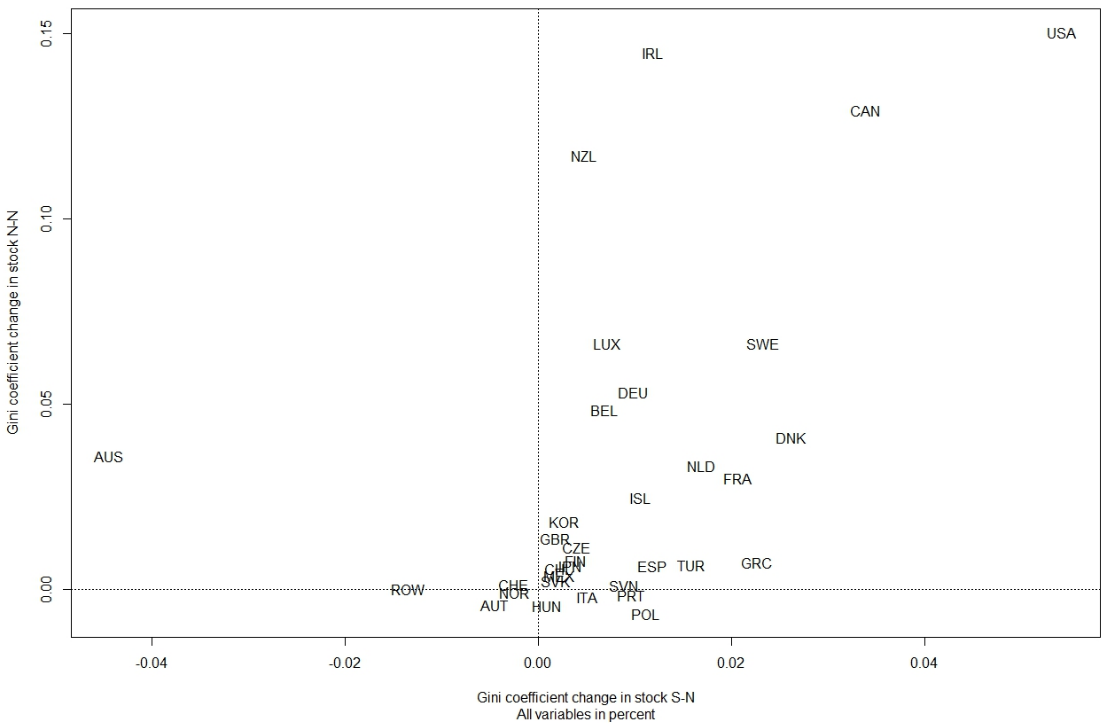

Figure 6: Inequalities due to migration in S-N and N-N, stock simulations.

Institut de Recherches Économiques et Sociales
Université catholique de Louvain

Place Montesquieu, 3
1348 Louvain-la-Neuve, Belgique

ISSN 1379-244X D/2013/3082/35