Trading Goods or Human Capital

The Winners and Losers from Economic Integration

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Abstract

The paper investigates the welfare consequences of liberalizing migration and trade between the OECD countries. The main outcomes comprise of the quantification of changes in welfare from deepening the economic integration in the OECD. The key findings of the paper are, that the potential gains from zeroing the trade barriers in OECD are moderate (1.5% in terms of real GDP), whereas the impact of reducing the barriers for migration in OECD is substantially more pronounced (growth higher by 2%). The implementation of the former policy is beneficial for every country in our sample (especially for the less integrated economies), whereas the latter provides positive outcomes for only a few richest, destinations. Furthermore, we consider a bilateral liberalization scenario between EU and US as well as between EU and Turkey, which are of major importance in the current geopolitical discussions. Finally, we examine the relations between trade and migration, concluding that they depend extensively on the type of shock imposed in a general equilibrium system.

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1 Introduction

The members of the OECD constitute one of the world's most integrated economic systems. In spite of this fact, reducing the legal barriers for goods' and peoples' mobility, at both local and global level, is a currently discussed issue on political and economic forums. Both decision-makers and scientists intensively debate about the possibility of implementing policies that would further integrate the OECD economic area in terms of labor movement and international trade. Their consequences may bring new incentives for an even more accelerated development, for the highly productive OECD economies as well as the catching-up states. In fact, the decisions about further liberalization of global flows of goods and people are decisive in terms of stimulating the performance of world economy, redistributing the welfare among and within the states and improving the well-being of people in the next decades. This paper provides some quantitative arguments for this debate. What we investigate are the welfare consequences of a hypothetical economic integration between the OECD countries, in terms of reducing the formal visa barriers for international migration and tariff and non-tariff restrictions for international trade.

Up to recently, many political and economic steps have already been taken to facilitate the international flows of goods and people. As early as in 1960, the European Free Trade Agreement was reached by several Western-European countries. This path-breaking treaty encouraged other authorities to develop local trade agreements and to deepen the regional integration of economies. On the contrary, multi-country free migration agreements are rather rare (apart from the EU states or the bilateral Australia - New Zealand treaty), showing that liberalization of migration is not a commonly preferred policy. Nowadays, during the ongoing discussions about liberalizing trade, capital flows (and possibly in the future: migration) between the European Union and the United States, the question of gains from abandoning the formal trade (and migration) barriers is rising again.[1] However, its academic context is now overwhelmed by the political, social and business dimensions, through which the main impact of this agreement would take place.

Plenty of theoretical and empirical studies quantify the macroeconomic consequences of liberalizing trade in the global context. The crude estimates, using gravity regressions and both partial and general equilibrium analysis, range from practically no positive effects to benefits of a magnitude of several percent points (Anderson and Yotov, 2011; Anderson et al., 2006; Anderson et al., 2000; Bouet, 2005; Francois et al., 2005; Lai, Trefler, 2004). More importantly, some recent findings suggest that a reduction in trade barriers may have a cross-country inequality-decreasing impact, though the within-country inequality would stay unaffected (see Bouet, 2005). The consensus is reached in the literature that bilateral trade tariffs constitute a small fraction of contemporary trade barriers. The majority of these restrictions is ascribed to non-tariff barriers.[2]

The literature on the consequences of liberalizing migration is far more scarce. There are some extremely optimistic estimates of gains from global reduction in barriers to labor mobility, which range from over 40% to even 150% in terms of welfare (Clemens, 2011; Hamilton, Whalley, 1984; Iregui, 2003; Klein, Ventura, 2007, 2009; Moses, Letnes, 2004). However, the recent evidence by Docquier et al. (2012) gives rise to a conjecture that

[1] The currently negotiated deal between EU and US is referred to as TTIP (Transatlantic Trade and Investment Partnership), for further details see: $http://ec.europa.eu/trade/policy/in-focus/ttip/$.

[2] The quantification of both tariff and non-tariff barriers for international trade is done, among others, by Anderson and Neary (2003, 2005) or Looi Kee et al. (2009).

these huge benefits are only illusory, because accounting for bilateral migration costs diminishes the overall gains to 2% - 4% at most. In their novel approach, liberalizing of migration means reducing the formal (visa) barriers for labor mobility.

This paper differs from the previous ones in several aspects. Firstly, a unified theoretical framework is provided. It allows to analyze various liberalization policies concerning both international trade and cross-country migration. The quantitative experiments concentrate on the welfare impact of liberalization for the developed countries which are the member states of the OECD, though the Rest of the World is modeled as a separate, aggregated economic area. Secondly, apart from that, some recent, politically hot questions about the consequences of bilateral liberalizations between EU and the US as well as EU and Turkey are addressed. Finally, we take advantage of the possibility to model trade and migration simultaneously in an endogenous way, by investigating the relations between flows of goods and flows of people in a general equilibrium system. This exercise is done by imposing exogenous shocks on trade/migration costs. The results show that substitutability and complementarity between the two phenomena are dependent on the type of shock one introduces. These findings contribute to the literature on the links between trade and migration, in a sense that they fill an important research gap. On the one hand, they allow to re-consider the traditional theory which states that trade and migration are substitutes. On the other hand, these findings challenge the empirically strong complementaries between trade and migration.

In order to quantify the welfare implications of liberalizing both migration and trade between the OECD countries, a multi-country, general equilibrium model is proposed. We assume endogenous migration and trade flows between 34 OECD countries and the Rest of the World, heterogeneous labor (low/high-skilled and domestic/foreign labor) and homogeneous firms. In the simulations, the wages, prices, trade and migration flows and the masses of varieties of goods are endogenized.

To calibrate the model we use the bilateral data on trade and gravity variables provided by CEPII. The data on bilateral stocks of migrants (both low and high-skilled, in year 2000) are taken from Artuc et al. (2014). The main macroeconomic variables origin from the World Development Indicators by The World Bank. Both the bilateral migration and trade costs are calculated numerically. Skill-specific migration costs are driven by a standard, logit expression derived from a random utility model. They are fitted to match perfectly the bilateral migration data taking the real wages computed in the model as given. The matrix of bilateral trade costs is defined by a set of structural gravity equations derived from the equilibrium conditions of the model. These costs are computed in such a way that the endogenous trade flows match the actual flows. Finally, the formal or legal parts of these two types of costs are estimated using standard econometric tools. The skill-specific and country-pair-specific migration costs are dependent on short-term and long-term visa dummies, taking into consideration the bilateral distances, populations, common borders and languages, in a fixed-effect OLS regression. Simultaneously, the overall trade cost is assumed to be explained by the equivalents for tariff and non-tariff barriers, considering bilateral distances, PPP parities, and other gravity variables.

The main finding of the paper is the quantitative assessment of a hypothetical full liberalization of migration and trade between the OECD countries. Eliminating visas between all these economies brings substantial positive welfare consequences only for the people living in several states.[3] On the contrary, liberalizing trade is positive

[3]The welfare gains above 1% are obtained for: New Zealand, Australia, Switzerland, Israel, Canada, and the US.

for all the OECD members. However, on aggregate, migration liberalization has much more visible effects than an intra-OECD free trade agreement. In all of the analyzed scenarios, the total gains from liberalizing migration (calculated as percent change in the OECD's real GDP) are higher than for trade integration. Assuming the benchmark parametrization, the former scenario brings an aggregate real GDP gain of 2.01%, whereas the latter 1.51%. Overall welfare effects (calculated as the changes in real wages) are then disaggregated, differentiating between four types of workers. Another conclusion is that after imposing a migration liberalization, the mobility of (mainly) the high-skilled workers increases substantially. This has some negative consequences for the poorer OECD countries, which lose a large share of their high-skilled labor due to the brain drain. This process is at the foundation of the unequal distribution of gains from international migration. Even though in 2000 many bilateral trade channels were already liberalized (in terms of tariffs), the gains from further opening trade are still substantial, as a result of abandoning high non-tariff restrictions. In contrast to the case of migration, the benefits are equivalently redistributed across the OECD nations, without a single losing country. The economies that win the most are the small ones which are relatively not well interlinked with other developed markets, so that the between-country inequality diminishes.

The reminder of the paper is organized as follows. In Section 2 the theoretical model is introduced. Section 3 contains discussions about the calibration and the model fit. The results of simulations are delivered in Section 4. In Section 5 several robustness checks are reported. Section 6 concludes.

2 The model

2.1 The benchmark framework

Consider a multi-country version of the model developed by Krugman (1980) extended with skill-heterogeneous and endogenous international migration.[4] In each of N countries indexed by i, there is an initial population equal to the sum of natives and foreign residents from all possible destinations, as reported in Artuc et al. (2014). We differentiate between low and high-skilled workers, both natives or originating from abroad.[5] They gain utility from consuming a combination of varieties of the consumption good, each of which being produced by one firm. In a particular country, all the producers have an access to the same technology, which leads to their homogeneity in the national scale.

2.1.1 Preferences and demand

An agent of either low or high-skilled education level, $s \in \{l, h\}$, born in country $j \in N$ who lives in country i, is interested in maximizing her nested utility function, given by:

$$U_{ij}^{s} = \alpha \ln \left[\left(1 - c_{ij}^{s}\right) u_{ij}^{s} \right] + \varepsilon_{ij} \tag{1}$$

[4]The equations of the model and the definition of competitive equilibrium are outlined in the Appendix 1. A detailed description of a similar model with exogenous migration is available in Aubry and Burzynski (2013).

[5]All the immigrants who live in country i are treated equivalently.

where c_{ij}^s describes the skill-specific, bilateral migration cost for a person born in country j living in country i.[6] Furthermore, the inner utility function, u_{ij}^s, represents the gain from consuming an optimal bundle of goods by a resident in country i. Assume that the agent's preferences towards different consumption goods are homothetic, and mapped by a CES utility function defined over a set of continuum varieties available in a destination country. Therefore, consumers of type s in country i originating from j maximize the explicit outer utility function:

$$U_{ij}^s = \alpha \ln \left[\left(1 - c_{ij}^s\right) \left(\sum_{h=1}^{N} \int_0^{B_h} x_{ijh}^s(k)^{\frac{\epsilon-1}{\epsilon}} dk \right)^{\frac{\epsilon}{\epsilon-1}} \right] + \varepsilon_{ij}, \tag{2}$$

where $x_{ijh}^s(k)$ stands for the amount of variety k produced in country h, exported and consumed by an individual in country i, who origins from j and belongs to a group s. B_h is the measure of the set of varieties available in country h. The additive term ε_{ij} is the individual-specific and country-pair-specific stochastic variable, which represents the subjective taste for emigrating from country j to i. The solution to this problem is subject to the budget constraint, in which the total expenditures are equal to the nominal remuneration of a person of type s (meaning that the aggregated value of nominal GDP is equal to the total supply of efficient labor times the nominal wage index: $X_i = W_i \bar{L}_i^T$).[7] The aggregated demand functions for a particular variety (summed over all the individuals living in country i) are simply:

$$x_{ih}(k) = \frac{p_{ih}(k)^{-\epsilon}}{P_i^{1-\epsilon}} X_i, \tag{3}$$

where, assuming that all the firms are identical with respect to their production technology and capacity:

$$P_i = \left[\sum_{h=1}^{N} \int_0^{B_h} p_{ih}(k)^{1-\epsilon} dk \right]^{\frac{1}{1-\epsilon}} = \left[\sum_{h=1}^{N} B_h \left(\tau_{ih} p_h\right)^{1-\epsilon} \right]^{\frac{1}{1-\epsilon}} \tag{4}$$

is the Dixit-Stiglitz aggregated price index in country i. Consequently, $p_{ih}(k) = \tau_{ih} p_h$ is the price of a variety k manufactured in country h and exported to country i. We assume that this figure is equal to the price dictated by a firm in country h multiplied by an ice-berg trade cost $\tau_{ih} \geq 1$.

Solving for the value of individual's indirect utility function, one obtains that it depends on the the real wage net bilateral migration cost. This value measures the welfare of a particular type of worker living in country i:

$$U_{ij}^s = \alpha \ln \left[\left(1 - c_{ij}^s\right) \frac{w_{ij}^s}{P_i} \right] + \varepsilon_{ij}. \tag{5}$$

2.1.2 Production and firms

In each economy i there is a continuum of homogeneous firms that choose to produce different varieties of the consumption good (indexed by $k \in [0, B_i]$). Consider a monopolistically competitive framework under the assumption of a single input required for production (which is heterogeneous labor). Moreover, both low/high-skilled and natives/migrants are imperfect substitutes, which leads to a nested CES production function. Firms decide about the

[6] For $i \neq j$: U_{ij}^l stands for the utility of a foreign low skilled worker, U_{ij}^h - foreign high skilled one, U_{ii}^l - native low skilled, and U_{ii}^h - native high skilled.

[7] "Efficient'' labor means the units of labor which are the CES composites of low/high-skilled efficient labor units, which, in turn, are CES combinations of native and foreign workers.

demand for different types of labor by solving a (two step) cost minimization problem. On the one hand, they choose between low and high-skilled workers, on the other hand, they look for the best combination of natives and foreigners for a given skill level. The optimal demands of firm k for the efficient low/high-skilled labor (labeled by superscripts l and h respectively), as well as the low-skilled natives and immigrants (high-skilled by analogy), is equal to:

$$\frac{\bar{\ell}_i^h(k)}{\bar{\ell}_i^l(k)} = \left(\frac{W_i^l}{W_i^h}\frac{\theta_i^S}{(1-\theta_i^S)}\right)^{\sigma_S}, \qquad \frac{\ell_i^l(k)}{\ell_{-i}^l(k)} = \left(\frac{w_{-i}^l}{w_i^l}\frac{\theta_i^N}{(1-\theta_i^N)}\right)^{\sigma_N}, \tag{6}$$

where θ_i^S (θ_i^N) is the country-specific share of GDP produced by high-skilled (by natives), σ_S (σ_N) is the elasticity of substitution between low and high-skilled (natives and migrants), $\bar{\ell}_i^h(k)$ ($\bar{\ell}_i^l(k)$ respectively) is the demand for efficient high-skilled (low-skilled) efficient labor composite and $\ell_i^l(k)$ ($\ell_{-i}^l(k)$ respectively) is the demand for the low-skilled natives (low-skilled immigrants from all destinations $j \neq i$). The notation for nominal wages is analogous. All in all, the variable unit cost of production is equal to the marginal cost and is identical across firms in country i:

$$c_i(k) = c_i = \frac{W_i}{A_i}, \tag{7}$$

taking A_i as a TFP level in country i, which is exogenous.[8]

Firms maximize their operational profits using the information on the consumers' demand (3). They decide on the price level, which leads to a standard solution:

$$p_i(k) = p_i = \frac{\epsilon}{\epsilon-1}c_i = \frac{\epsilon}{\epsilon-1}\frac{W_i}{A_i}, \tag{8}$$

so that the profit margin constitutes a constant share of the marginal cost of production.

Countries are characterized by entry barriers for the entrepreneurs. In order to start production, each firm has to spend a certain amount on (human) resources devoted exclusively to non-production purposes. Since the entry is free, in the equilibrium, the operational profits are equal to the value of the fixed cost. After aggregating across all the companies in country i, one arrives at a simple expression:

$$B_i = \frac{\bar{L}_i^T}{\epsilon f_i}, \tag{9}$$

where $\bar{L}_i^T$ stands for the total efficient labor supply in country i (employed for both production purposes and for fixed entry cost) and f_i is the fixed cost of entry expressed in the number of efficient workers.

In the equilibrium, the consumption good market clears and the trade is balanced in each country. These conditions lead to a well known formulation of the gravity equation:

$$\frac{X_{ij}}{X_j} = \frac{X_i\left(P_i/\tau_{ij}\right)^{\epsilon-1}}{\sum_{h=1}^N X_h\left(P_h/\tau_{hj}\right)^{\epsilon-1}}, \tag{10}$$

which imposes that the relation of exports from country j to i to the GDP level in country j is a function of country i's size, its price level and the bilateral trade cost. Furthermore, the labor market clears, which is equivalent to setting the equilibrium wages for each labor type: (w_i^l, w_i^h, w_{-i}^l, w_{-i}^h respectively).

[8] As a robustness check, the TFP factor is assumed to be modeled as a Lucas externality - dependent on the share of high-skilled workers in population.

2.2 Endogenizing migration decisions

The next step is to define the process of endogenous cross-country labor flows as a consequence of individuals' reactions to economic incentives. First of all, let it be stated that the decision about the choice of the country of residence is reached comparing the real wage levels net the migration cost. Assume that each individual (either low or high-skilled) is heterogeneous in terms of her preferences for migrating. In particular, as in the previous analysis, the utility of a person of a given skill, born in country j and living in country i, is composed of a deterministic and a random term. The former term is equivalent to the value of indirect utility (derived in the previous section) net migration cost:

$$U_{ij}^s = \alpha \ln \frac{w_{ij}^s}{P_i} + \alpha \ln \left(1 - c_{ij}^s\right) + \epsilon_{ij},$$

where the sensitivity of individual's utility with respect to welfare is fixed to $\alpha = 1$. The bilateral cost of migration is expressed as a share of real income that is lost due to moving expenditures or visa costs. Additionally, it represents the monetary value of psychological, sociological or cultural disadvantages of immigrants. Notice that $\forall i \; \forall s \; c_{ii}^s = 0$. The explicit assumption is that each person has a perfect information about the quality of life in all of the analyzed countries. The latter term, that is the random component: ε_{ij}, models different attitudes across individuals towards emigration. In order to capture the heavy tails in the distribution of peoples' preferences over destinations, assume that ε_{ij} is drawn from a Type I Extreme Value Distribution (EVD) with a zero mean and a variance normalized to $1/\alpha = 1$.[9] In such a way, an individual faces a problem of choosing the destination country, taking into consideration the objective welfare measures (real wages net migration costs) and subjective propensity towards living in a particular state (stochastic, individual-specific term). This problem boils down to a discrete choice program analyzed by McFadden (1984). Applying the McFadden's theorem, the probability that a person of skill s born in country j migrates to country i is equal to:

$$\pi_{ij}^s = \Pr[U_{ij}^s = \max_{k \in N} \left(U_{kj}^s\right)] = \frac{\exp\left(U_{ij}^s\right)}{\sum_{k=1}^N \exp\left(U_{kj}^s\right)}. \tag{11}$$

Concentrating on the aggregated flows of migrants, let M_{ij}^l (M_{ij}^h) denote the number of low-skilled (high-skilled respectively) people born in country j, who emigrated and live in country i. In the same manner, the number of natives who actually live in their country of birth, j, is expressed by: M_{jj}^s for $s \in \{l, h\}$. Using the above derived probabilities to migrate and the exact form of the logarithmic utility function, one can easily calculate the shares of emigrants from j to i to stayers in j:

$$\frac{M_{ij}^s}{M_{jj}^s} = \left(\frac{w_{-i}^s / P_i}{w_j^s / P_j} \left(1 - c_{ij}^s\right) \right)^{\alpha}. \tag{12}$$

All in all, the aggregated number of migrants and stayers in country j is a function of four endogenous variables, one exogenous variable and one parameter. The higher is the real wage ratio between the destination i and the source j, the larger is the actual share of migrants from j to i. What is crucial, these figures are dependent not only on the bilateral (nominal) wages, but also on the price indexes in both countries. This means that the

[9] It can be proven that $1/\alpha$ is related to the dispersion of the EVD (see Appendix 2).

country's location in the global international trade network plays an important role in determining migration.[10] The only exogenous factor that drives the migration flows is the bilateral cost of resettlement. Using the actual data on bilateral migration and the country-specific endogenous nominal wages and price indexes, one can solve the equation (12) for c_{ij}^s. In such a way, it is possible to fully identify the matrix of bilateral (skill-specific) migration costs for a given α. Finally, the parameter α, which is defined as the sensitivity of individual's utility with respect to the real income, is in fact the elasticity of the ratio of migrants with respect to the real wage ratio. Both the further decomposition of migration costs and the choice of the actual value of α are investigated in the following section

3 The quantitative properties of the model

In this part of the paper, we discuss the model calibration. Firstly, a short summary of model's parametrization is presented, followed by the calibration algorithm. Then we define the identification strategy for defining the migration and trade liberalization policies. Finally, the main endogenous variables are correlated with actual data.

3.1 Parametrization

Three types of exogenously given parameters can be distinguished in the proposed model: the world-economy-wide, the country-specific and the country-pair-specific values. The first group of parameters is common for all the countries in the analyzed system. Their values are taken from the literature and are assumed to be consensual. The elasticity of substitution between varieties of goods, ϵ, is estimated by Feenstra (1994) in the range of [2.96; 8.38] and by Broda and Weinstein (2006). As a reference, assume that $\epsilon = 4$. For the elasticities of substitution between different types of labor (either σ_S or σ_N) we take the values reported by Ottaviano and Peri (2012) and assumed by Docquier et al. (2013), that is: 1.75 and 20 respectively. The parameter describing the agent's sensitivity to net real income, α, is assumed to be equal to 1 in the reference scenario. As a robustness check we take $\alpha = 0.7$, as in Bertoli et al. (2013) which in fact provides less dispersed results.

As for the second group of parameters, we take the country specific shares of value added provided by different types of labor (or equivalently: preferences of firms towards different types of workers). The values of shares of high-skilled (θ_i^S) and the shares of migrants (θ_i^N) are calculated using the data describing the wage ratios between either the low/high-skilled or migrants/natives taken from Hendricks (2004) and Buchel and Fritsch (2005) respectively.

The country-pair-specific parameters are the ones that describe the bilateral costs of migration (for low and high-skilled separately) and the ice-berg costs of trade. These values are fitted in the calibration process using the general equilibrium conditions: the random utility model equations for migration costs and the system of gravity equations for trade. Then, the obtained costs of migration and trade are decomposed into their reducible and non-reducible parts, as described below.

[10] As, according to equation (4), P_i is a function of the bilateral trade costs between country i and all of the countries that export to i.

3.2 Calibration of the model

Considering the fact that the proposed model assumes some multidimensional nonlinear relations between the key endogenous variables, we choose to analyze its outcomes through the numerical simulations of the properties of the general equilibrium. Therefore, both the calibration and simulation procedures are conducted iteratively, to restore all the equilibrium conditions in the system of $N = 35$ OECD and Rest of World economies.[11]

For the calibration part, we propose the following algorithm of proceedings.[12] The first step consists of setting the values to all the exogenously given parameters of the model (described in detail in the preceding section). The full set of parameters contains the country specific shares of high-skilled / migrants in producing the value added, the elasticities (these are: ϵ - elasticity of substitution between varieties, σ_S - elasticity of substitution between low and high-skilled, σ_N - elasticity of substitution between natives and migrants) and the sensitivity of individual's utility with respect to the net real income, α.

Secondly, using the macroeconomic data, we define the vectors of the exogenous macroeconomic variables. Actual levels of GDPs are taken from the World Bank's World Development Indicators and the supplies of different types of labor from the database are provided by Artuc et al. (2014). Then, the fixed cost proxy is constructed using the data from Doing Business Indicators by the World Bank.[13] Having these vectors, one is able to determine the wage indexes W and the masses of varieties B from the equilibrium conditions.

The next step is the iterative procedure of fitting the TFP residuals and the bilateral trade costs matrix $[\tau_{ij}]$ taking into consideration two criteria. Not only the general equilibrium of the model has to be ensured (all the equilibrium conditions reduce to a system of N zero-profit equations which then are solved for the TFP residual) but also the model aspires to have a close fit to the real trade data. The latter is controlled by the trade cost matrix. What is proposed, is the following loop. Firstly, the solution to the system of $N \times (N-1)$ gravity trade equations is calculated, using the *nleqslv* package in R.[14] This partial solution is then used to restore the general equilibrium of the model by iteratively solving N zero-profit equations and fitting the TFP residuals. After computing the endogenous bilateral trade flows, the model trade matrix is compared to the actual trade matrix and the distance between the two is calculated (which is the sum of squares of differences between particular entries). The iteration on $[\tau_{ij}]$ and A stops when this distance is minimized. Furthermore, using the labor market equilibrium conditions, the skill and origin-specific wages are calculated in every country. To do this, once again we use a non-linear solver which is applied N times, country by country. Finally, the bilateral migration cost matrices (for low and high-skilled workers) $\left[c_{ij}^l\right]$ and $\left[c_{ij}^h\right]$ are determined by the random utility model specification, which completes the calibration.

[11] For a detailed description of the simulation procedure, see Appendix 3.

[12] The steps of the algorithm are explicitly depicted in the left panel of Figure (A3.1).

[13] In detail, we calculate the fixed cost vector as an unweighted synthetic indicator of three standardized variables: the number of days needed to start business, the cost of starting a business (as a share of GNP p.c.) and the survival rate of businesses.

[14] The solver for systems of nonlinear equations in *nleqslv* is based on Dennis and Schnabel (1996). We use the Broyden method which is an extension of the Newton method of solving systems of nonlinear equations.

3.3 The liberalization of migration barriers

The total cost of migration, expressed as a loss in the relative real income after migrating, is a black box that represents several aspects of the migration decision. Keeping in mind its standard, microeconomic interpretation (as a sum of individual moving, visa and psychological costs), this figure can be modeled from a macroeconomic perspective. What can be proposed as the reference identification strategy, is a simple estimation of the impact of formal migration barriers on the actual bilateral migration flows. Let us consider the logarithm of equation (12):

$$\ln\left(\frac{M_{ij}^s}{M_{jj}^s}\right) = \alpha \ln\left(\frac{w_{-i}^s/P_i}{w_j^s/P_j}\right) + \alpha\left(1 - c_{ij}^s\right). \tag{13}$$

The goal is to calculate the extent, in which $1 - c_{ij}^s$ is explained by the formal migration costs (that is all the migration barriers which are designed by the authorities to restrict bilateral migration flows, i.e. the visa costs). Assume that these restrictions may be represented by two dummy variables. The first one, $ShortVISA$ represents an existence of a bilateral agreements thanks to which citizens from one country may travel to another country without a visa (for example the visa waiver program introduced by USA). Therefore, if $ShortVISA_{ij} = 1$, then there are formal restrictions to migrate from country j to country i for a short periode. The second variable is $LongVISA$, which represents a free migration agreement between two countries. Consequently, the citizens from one country may travel and work in another country without any restrictions (for example the workers between the EU countries or between Australia and New Zealand). Thus, if $LongVISA_{ij} = 0$ then there is a free labor movement between i and j. One would expect that the impact of both $ShortVISA$ and $LongVISA$ on bilateral migration flows is negative, because abolishing visas should provide a positive migration shock. To identify it, several estimations of equation (13) are provided (see Table A4.1 for the cost ascribed to the low-skilled and Table A4.2 for the case of the high-skilled). We make an assumption, that apart from the visa dummies, the bilateral cost of migration is a function of the distance between sending and receiving countries, the size of populations of both countries and additional fixed effects.

The reference regressions in Tables A4.1 and A4.2 are labeled by number (5). These models have the best properties in terms of residuals and specification. Considering the cost for the low-skilled, we obtain the following result (see Table A4.1):

$$\begin{aligned}\ln\left(\frac{M_{ij}^l}{M_{jj}^l}\right) = 0.942 \ln\left(\frac{w_{-i}^l/P_i}{w_j^l/P_j}\right) - 0.500 ShortVISA_{ij} - 0.607 LongVISA_{ij} \\ -0.252 \ln D_{ij} - 0.119 \ln Pop_j + 2.299 Bord + 1.565 Lang - 4.344.\end{aligned} \tag{14}$$

Introducing a full free migration agreement would increase the share of bilateral migrants by over 200%.[15] The elasticity of migration share with respect to the distance is close to -0.252. The higher the population in the sending countries, the lower the propensity to migrate. Finally, the elasticity of migration share with respect to the real wage ratio is very close to the reference value of the corresponding parameter $\alpha = 1$.

[15] Because: $2.03 = \exp(0.5 + 0.607) - 1$.

In the case of the cost for the high-skilled, the former equation takes the following form:

$$\ln\left(\frac{M_{ij}^h}{M_{jj}^h}\right) = 1.100\ln\left(\frac{w_{-i}^h/P_i}{w_j^h/P_j}\right) - 0.473ShortVISA_{ij} - 0.708LongVISA_{ij} \\ -0.166\ln D_{ij} - 0.093\ln Pop_j + 1.325Bord + 1.546Lan - 4.911. \tag{15}$$

The high-skilled workers are more responsve to the real wage ratio. They are also more vulnerable to the long-term visa, although distance, border and language seem to be less important in their migration decisions.

The above estimates are in line with the latest results presented in the literature. In the paper by Bertoli and Moraga (2013) the authors regress the quarterly migration rate to Spain in 1997 - 2009 on real GDP p.c. and visa requirement dummy. The magnitude of their coefficient, which ranges from -0.5 to -1.3, is very close to the values obtained in equations (14) and (15). Grogger and Hanson (2011) estimate the linear version of equation (13). They find that the explained variable (which is the log ratio of emigrants in the destination to the population in the source) significantly depends on both visa requirement and Schengen dummies. The estimates, taking the difference in pre-tax real wages as the main regressors, are equal to 0.335 and 0.430 respectively. Finally, Beine et al (2011) determine the importance of migration diasporas on bilateral migration flows using a gravity representation and controlling for belonging to the Schengen Area. Their estimates range from 0.06 to 0.60 for the migration flows to the OECD countries in 2000.

The scenarios of liberalizing migration are designed as follows. The migration costs between all the pairs of countries with visa requirements are reduced by a value corresponding to the estimated coefficients.[16] Assuming new migration cost matrices, one can endogenously generate the migration flows after imposing the liberalization policy. An important fact about the above proposed method is, that the liberalization of migration defined in such ways may be considered as an independent, exogenous shock in the system of N national economies. Consequently, this kind of disturbance has a straight impact only on migration and, in general, is not simultaneously affecting trade in a direct way. Therefore, the conducted counterfactual simulations are a realization of an experiment in which "[we] look for some exogenous events that cause variation in bilateral migration stocks but have no direct effect on bilateral trade'' - the postulate raised by Felbermayr et al. (2012) to fully tackle the endogeneity problem in the analysis of the relations between migration and trade.

3.4 The liberalization of trade barriers

The second type of counterfactual simulations is related to trade liberalization. Once again, one aims at identifying the part of the bilateral trade cost which is the consequence of formal restrictions. Followng Anderson and Neary (2003, 2007) we not only consider the tariffs imposed on imported goods, but also we analyze the non-tariff barriers for trade (which, according to some recent findings, constitute the majority of contemporary trade restrictions). To identify them we use the estimates by Looi Kee et al. (2009) who compute the implied tariff rate that would be equivalent (in terms of the value of import/export) to the observed non-tariff barriers. These numbers represent the average across all importers/exporters from/to a particular country.

The identification strategy assumes estimating the impact of formal trade barriers by using simple regressions. However, the dependent variable is now the log of bilateral trade cost, τ_{ij}, which was fitted to match the trade data.

[16] In fact, we do not decrease the cost, but increase the net share of real wage $1 - c_{ij}^s$, which then is translated into a change in the cost.

Apart from the tariff and non-tariff levels, we regress it on the logarithm distance between exporting and importing countries, population in the exporting country, the relation between PPP in importing and exporting country and exporter/importer specific fixed effects.

The reference model (see Table A4.3), characterized by the best statistical properties, is denoted by (4).

$$\begin{aligned}\ln \tau_{ij} = {} & 0.600 Barriers_{ij} + 0.276 \ln(D_{ij}) - 0.095 \ln Pop_j + 0.288 \frac{PPP_i}{PPP_j} \\ & - 0.159 Bord - 0.273 Lang + 0.810.\end{aligned} \tag{16}$$

Both formal barriers (sum of tariff and non-tariff restrictions) and distance increase the bilateral trade cost. An increase in the barrier equivalent by 1 percent point enlarges the bilateral trade cost by 0.6%. The elasticity of τ_{ij} with respect to the distance is slightly smaller than 0.3. The higher the population in the exporting country, the lower the trade cost. Finally, an amelioration of purchasing power parity for the importing country would increase the cost of exporting to this country. Both common border and common language facilitate trade, by decreasing its bilateral cost. In order to liberalize trade we set all the tariff and non-tariff equivalents to 0.

The above result matches well with the hitherto estimates of the impact of trade liberalization on bilateral trade flows. What we obtain in the equilibrium is an average increase of 17.8% in trade flows between the OECD countries after simulating the reference scenario.[17] Silva and Tenreyro (2006) estimate the impact of free trade agreements on trade for 136 countries in 1990 at the level of 66% using a standard OLS model and 20% using the Poisson Pseudo Maximum Likelihood method. Olivero and Yotov (2011) construct a dynamic gravity model for the Eurozone. Using a GMM estimator they find that the free trade agreement raises the bilateral trade by 14%. Helpman et al. (2008) estimate gravity equations for the set of bilateral trade flows between 158 countries in year 1986. Using a two-stage method they find that a free trade agreement increases the trade flows on average by 41% (in a probit model), 13% (in a nonlinear least squares model) and 27% (assuming a polynomial model). Finally, Baier and Bergstrand (2007) quantify the implications of free trade agreements on bilateral trade using a 1960 - 2000 panel data for 96 potential trading partners. According to their results, an access to a free trade region may increase the trade from 14% (OLS estimate without fixed or time effects) to 100% (OLS with time and bilateral fixed effects) in 10 years.

3.5 Model Fit

In order to check the main characteristics of the calibrated model, in what follows we report the comparison between several key endogenous variables with their real economy counterparts (see Figure A3.3). The calibration concentrates on fitting the matrices of global migration and international trade matrix, allowing wages, prices, number of varieties and the TFP levels to float freely. Therefore, the only restrictions imposed on these endogenous variables are defined by the random utility migration equations, gravity trade equations and the equilibrium conditions which reduce to the system of zero-profit conditions (taking the exogenous macroeconomic variables and parameters values as given).

In terms of the aggregated wage index, the model provides a satisfactory matching with actual data. Firstly, considering the nominal wage per person, we obtain a perfect fit, because both the GDP levels and the population

[17] Including trade with the Rest of the World.

sizes are taken from the data. More appealing is the relation of the real wage per efficient labor unit, which is the proxy for welfare measure. Two components play a role here: the nominal wage per efficient labor unit, $W_i = X_i/\bar{L}_i^T$, which is driven only by the data, and the price index P_i which is computed in a general equilibrium of the model and is not directly affected by data. In this case, the correlation between W_i/P_i and the GDP p.c. in the sample of 34 OECD countries is equal to 0.6545.

The mass of product varieties, which is the crucial concept of the market size effect in the model, is not easily observed in the data. A good benchmark for this figure may be the actual number of companies registered. The Krugman's market size equation defines that: $B_i = \bar{L}_i^T / (\epsilon f_i)$. Taking the efficient labor aggregate from the data and a particular value of the elasticity of substitution between varieties ϵ, it is clear that the mass of varieties depends on the country specific fixed cost of entry f_i which in our model is assumed to be exogenously calculated from the Doing Business Indicators. Thus, the correlation between B_i and the actual number of firms at the level of 0.7473 seems quite satisfactory.

Another unobservable moment of the calibrated model is the TFP level. In the calibration procedure, this vector is matched to obtain the general equilibrium by equalizing both sides of the zero-profit equation. There hardly exists any convincing reference variable for validating the productivity level of labor. The closest one is the indicator of GDP per hour worked. The correlation between this variable and the calibrated TFP is equal to 0.3308. Another could be the share of high skilled workers in the population. In this case the relation is quantified by the correlation equal to 0.3919. However, one has to realize that the model measure of TFP incorporates much more other aspects of economic environment, for example the quality of institutions, the intensity of capital endowments or an access to capital markets.

As the last validation of the calibration algorithm, the comparison of endogenous model trade matrix and actual bilateral trade values is reported (see Figure A3.2). It enables to evaluate both the market equilibrium price indexes and the bilateral ice-berg trade costs which are numerically fitted to maximize the Euclidean distance between both trade matrices. The correlation between real and model trade values equals 0.9998 and is not perfect due to the fact that we impose that the ice-berg cost of producing for the home market is always equal to 1, whereas any bilateral cost cannot be smaller than this value. Furthermore, the correlation between model and real trade shares is equal to 0.9987.[18]

4 The results of simulations

In order to answer the questions about the quantitative consequences of liberalizing migration and trade between the OECD countries, three sets of simulations are conducted. The first one comprises of liberalizing migration

[18]The regression line that relates both matrices is:

$$X_{ij}^{REAL} = 1.0042 \cdot X_{ij}^{MODEL} - 1.1 \cdot 10^8, \qquad R^2 = 0.9996,$$

or alternatively without a constant:

$$X_{ij}^{REAL} = 1.0041 \cdot X_{ij}^{MODEL}, \qquad R^2 = 0.9996.$$

This means that only 0.045% of the real bilateral trade flows is not explained in the calibrated model. This result seems to be very promising in terms of analyzing the general equilibrium effects of liberalizing both migration and trade.

among all the OECD countries. In the second set, the trade liberalization between the OECD economies is considered. In the last set of simulations, the two former policies are put together. The aim of these calculations is, on the one hand, the quantification of the welfare impact of reducing the restrictions in international exchange for the natives and migrants in the analyzed countries. On the other hand, we are interested in describing the simultaneous movement of migration and trade, and verifying the conjecture about their potential substitutability or complementarity.

4.1 Liberalization of migration

The simulation in which the liberalization of migration policy between all the OECD countries is imposed, is conducted for three values of the magnitude of liberalization (measured by the estimated parameters of short-term and long-term visas, in the skill-specific migration cost regressions). The reference scenario (let us call it MID for middle values) assumes the $ShortVISA$ and $LongVISA$ parameters are equal to -0.500 and -0.607 respectively for the low-skilled and -0.473 and -0.708 respectively for the high-skilled. Then, to be able to estimate the sensitivity of the model with respect to these crucial figures, we consider two other scenarios (call it MIN for minimal values and MAX for maximal values) in which we take the lower and upper bound of the visa dummies estimates (see Tables A4.1 and A4.2). Finally, we obtain the parametrization depicted in Table 1.

Table 1: The Parametrization of sensitivity of migration cost to formal migration barriers

	Low skilled			High skilled		
	MIN	MID	MAX	MIN	MID	MAX
Short VISA	-0.261	-0.500	-0.553	-0.361	-0.473	-0.696
Long VISA	-0.467	-0.607	-0.976	-0.495	-0.708	-0.788

In the following Table 2 the aggregated results for all three scenarios are gathered. In all the cases liberalizing migration is positive for the overall level of real GDP in the OECD, but harmful for the EU economy.

Table 2: Aggregated gains from liberalizing migration

	EU							OECD						
	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp
MIN	-1.85%	-1.59%	-4.02%	12.91%	14.99%	-1.32%	-1.32%	1.40%	-1.72%	-2.24%	21.99%	20.89%	-0.31%	-0.31%
MID	-2.79%	-2.25%	-6.20%	18.45%	23.28%	-1.93%	-1.92%	2.01%	-2.44%	-3.47%	31.32%	32.33%	-0.45%	-0.45%
MAX	-3.57%	-4.19%	-7.32%	34.88%	27.07%	-2.34%	-2.33%	3.28%	-4.46%	-4.16%	57.39%	39.25%	-0.28%	-0.28%

The table provides the percent changes in real GDP, population of natives (low-skilled and high-skilled), population of residents (low-skilled and high-skilled), value of imports and exports in the EU and OECD (considering 3 scenarios: MIN, MID and MAX), after liberalizing migration between all OECD countries.

Considering the reference scenario of liberalizing migration between all OECD countries (MID), the total real GDP in the OECD increases by 2.01%. This shows that, accepting all the assumptions of the model, the potential gains from reducing the migration barriers are not negligible. In the upper case scenario (MAX), these overall

benefits are raising up to 3.28%. On the contrary, the European Union encounters serious losses after abandoning visa restrictions. In the benchmark scenario the real GDP drops by 2.79%, whereas in the MAX scenario the loss is -3.57%. These severe consequences are mainly due to the large outflow of Europeans to the North American and Oceania countries. Indeed, even though the population of residents increases, the exodus from the EU is strongly dominating.[19] Furthermore, both imports and exports decrease after implementing no-visa policy.

Let us concentrate on the results obtained from the reference scenario (MID). The detailed, country-specific outcomes are available in Table 3. In the analysis, the light is shed on the overall effect on aggregated wage index, as well as skill/origin specific real wages and populations of workers of all types. The first striking observation is that the majority of OECD countries are losing after the liberalization of migration. The ultimate winners are New Zealand, Australia, Switzerland, Israel, Canada and the US, with an increase in overall welfare of natives ranging from over 1% to over 5%. The natives in Mexico, Slovakia and Poland lose about 2% of their real wages. On average, the change in the wage index in the OECD countries is leveled at 0.01%.

[INSERT TABLE 3]

In the majority of countries the high-skilled workers are relatively better off (that concerns both natives and immigrants), therefore the within-country inequalities increase. A simple explanation is that an intensive outflow of the high-skilled workers from the drained countries automatically raises the nominal wages of the high-skilled stayers (as a consequence of an imperfect substitution between low and high-skilled labor). An extreme example may be Poland, where the low-skilled natives lose 4.26% and the high-skilled gain 1.58%.

All of the analyzed countries experience an outflow of their citizens, which is an expected consequences of freeing labor mobility. Simultaneously, the stock of low/high-skilled immigrants in the OECD countries increases substantially, on average, by 27% and 32% respectively. Our results confirm that the high-skilled workers are significantly more mobile than the low-skilled ones. Therefore, in order to provide the after-liberalization benefits, a country has to not only attract new immigrants, but also discourage natives from emigrating. For example, the largest exodus of high-skilled workers takes place in Ireland (almost 30% of the current stock), due to a sizable increase in emigration to the US, the UK and Australia. Despite of this, Irish natives gain about 0.6%. Potential losses from emigration are more than compensated by a new wave of immigration. On the contrary, the Scandinavian countries, which do not experience a large emigration, are not the most popular destinations for new immigrant. In consequence, the welfare of natives decreases after the liberalization.

To sum up this part of the results, one can state that the necessary condition for providing benefits from migration liberalization is retaining the stock of (mainly high-skilled) workers, either by convincing them not to emigrate or by inviting them from abroad. Otherwise, the emigration of well educated people causes the increase in within-country inequality. Furthermore, what the model predicts, is a continuous brain drain effect from the relatively poorer to the relatively wealthier economies. The benefits caused by the liberalization of intra-OECD migration are concentrated in only several countries, the wealthiest ones, so that the between-country inequality raises. The key message for the remaining countries is that they need to provide incentives which would accelerate the accumulation of the human capital. Otherwise, the losing countries may find themselves in a vicious circle or an equilibrium being a low-welfare poverty trap (in the sense of de la Croix and Docquier (2012)).

[19] The set of results equivalent to Table 2, but containing the changes in variables, not percent changes, is available in Appendix 5.

4.2 Liberalization of trade

The simulations of the trade liberalization are conducted in the same way as the precedent ones. Again we assume three scenarios, characterized by small, medium and large sensitivity parameter, which is now the elasticity of trade cost with respect to the level of tariff and non-tariff barriers. Table 4 summarizes the values of this parameter.

Table 4: The Parametrization of sensitivity of trade cost to tariffs

	MIN	MID	MAX
Tariffs and NTB	0.343	0.600	0.703

These three scenarios enable to study the sensitivity of the results to the trade liberalization parameter. Table 5 shows the aggregated gains from liberalizing trade, which are positive for both EU and OECD.[20]

Table 5: Aggregated gains from liberalizing trade

	EU							OECD						
	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp
MIN	0.52%	-0.01%	-0.03%	0.29%	0.19%	3.95%	4.19%	0.79%	0.04%	0.02%	0.06%	0.48%	12.07%	12.07%
MID	0.97%	-0.02%	-0.07%	0.53%	0.35%	7.29%	7.72%	1.51%	0.07%	0.03%	0.09%	0.90%	22.48%	22.48%
MAX	1.17%	-0.03%	-0.08%	0.64%	0.42%	8.71%	9.23%	1.83%	0.09%	0.04%	0.10%	1.08%	26.99%	26.99%

The table provides the percent changes in real GDP, population of natives (low-skilled and high-skilled), population of residents (low-skilled and high-skilled), value of imports and exports in the EU and OECD (considering 3 scenarios: MIN, MID and MAX), after liberalizing trade between all OECD countries.

Assuming the reference scenario, the overall gain in real GDP by the OECD countries is 1.51%, and is slightly less in comparison to what was obtained for liberalizing migration. In contrast to the previous results, the EU is now gaining 0.97% in terms of real GDP. Taking the upper bound of the estimates, increases the benefits to 1.83% for the OECD and 1.17% for the EU.[21] The fact is that in 2000 the OECD economies were already well integrated, and the tariff barriers were rather low. However, the non-tariff barriers were still substantial. All the changes in real GDPs are smaller (in their absolute values) than the corresponding values obtained in the migration liberalization scenarios. This would mean that the potential gains from reducing the trade barriers are significantly lower than the potential gains or losses from intra-OECD no-visa policy. On aggregate, the flows of people slightly increase after liberalizing trade. Simultaneously, one can observe a strong intensification of trade flows either for the EU countries (over 7%) and the OECD countries (over 22%). Additionally, the trade balance for the EU ameliorates.

Analyzing the country-specific macroeconomic indicators (see Table 6), it is immediate to state that all the OECD countries experience a growth in their equilibrium real wage levels. The macroeconomic gains from trade range from about 0.3% for the Mediterranean countries (Portugal, Spain, Greece) to up to $8 - 10\%$ for small and relatively worse integrated countries like Hungary, Estonia and Slovenia.[22] The average increase in the real wage index due to trade liberalization is 3.3%. The mechanism which stand behind these results boils down to a

[20] For the changes in values, see Appendix 5.

[21] Anderson and Yotov (2011) estimate the efficiency gains from trade at the level of 0.62%.

[22] Mexico gains mainly thanks to the US.

simple positive price effect, which concerns mainly those economies which are least opened to international trade. Declines in bilateral tariffs and non-tariff restrictions spur exports, which indirectly raises welfare. Simultaneously, these policies lower the prices of imported goods, which directly translates into higher real wages of agents.

[INSERT TABLE 6]

The endogenous process of human migration follows the expected pattern. People flow to the countries, which gain the most from reducing the trade barriers. Therefore, the highest increases in the stock of migrants may be observed in Hungary, Mexico or Slovenia. This phenomenon is dictated by the decision rule of migration destination, in which individuals compare the welfare levels in all the possible destinations. The highly developed countries which do not take advantage of the reduction of tariffs (such as UK, Finland or the US) are actually repelling workers. Such a result depends on the fact that these economies are already well integrated in the global trade network, their barriers for trade are relatively low and there is no further room for liberalization of exchange with their main foreign partners. As a consequence, they cannot benefit from zeroing the trade limitations, which in fact causes that their relative attractiveness actually diminishes. Thus, it is safe to say, that liberalizing trade accelerates the cross-country convergence and reduces the between-country inequality in welfare. In addition, the within-country inequality slightly reduces in the majority of states.

4.3 Liberalization of migration and trade

The last set of simulations concerns a full liberalization of both migration and trade barriers. As before, three possible scenarios are proposed, labeled by MIN, MID and MAX. The aggregated consequences from this policy are presented in the following Table 7[23]:

Table 7: Aggregated gains from liberalizing migration and trade

	EU							OECD						
	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp
MIN	-1.37%	-1.61%	-4.07%	13.12%	15.10%	2.61%	2.85%	2.16%	-1.66%	-2.21%	21.82%	21.30%	11.82%	11.82%
MID	-1.92%	-2.29%	-6.31%	18.79%	23.41%	5.29%	5.72%	3.44%	-2.32%	-3.42%	30.79%	33.03%	22.20%	22.20%
MAX	-2.56%	-4.27%	-7.47%	35.12%	27.18%	6.29%	6.80%	4.97%	-4.28%	-4.09%	56.27%	40.03%	27.09%	27.09%

In the reference scenario, the real GDP in the OECD raises by 3.44%, whereas the EUs production goes down by 1.92%. Thus, the effect of migration is strongly dominating in the EU, which shows that the loss in terms of human capital cannot be regained by liberalizing the trade in goods. For all the scenarios both migration and trade significantly intensifies. In terms of cross-country comparison, Table 8 summarizes the key results.

[INSERT TABLE 8]

The proposed model is flexible enough to tackle the problem of local liberalization of trade and migration between any two disjoint sets of OECD countries. Keeping everything else equal, one can disentangle the magnitude of welfare effect of such bilateral decreases of formal migration and trade barriers. Following the political

[23]For the changes in values, see Appendix 5.

debate, we decided to study and quantify the consequences of liberalizing flows of goods and workers between the European Union and the United States, as well as the European Union and Turkey.

4.4 Liberalization between EU and the US

In the recent years, we observe an intensification of the debate about liberalizing both trade and migration between two largest members of the OECD that is the United States and the European Union. The potential gains from reducing all trade barriers between these two federations were calculated by the CEPR for the European Commission.[24] In March 2013, a report was published, saying that the benefits for the EU are estimated at the level of 119 billion euro (each year), whereas the US would get about 100 billion euro.[25] The increase in GDP in the rest of world's countries may reach the level of almost 100 billion euro. The authors conclude that the EU exports to the US would raise by 28%, which translates into a 6% increase in total EU exports. There are no official estimates of potential consequences of liberalizing the bilateral migration between EU and the US.

In Table 9 we study the aggregated effects on real GDP for the EU, the US and the OECD. The policy of liberalizing trade and migration separately is discusses, followed by the joint results.

Table 9: Aggregated gains from liberalizing trade and migration between EU and US

	Trade			Migration			Trade and Migration		
	MIN	MID	MAX	MIN	MID	MAX	MIN	MID	MAX
EU	0.22%	0.41%	0.50%	-1.08%	-1.67%	-2.19%	-0.86%	-1.26%	-1.69%
US	0.19%	0.35%	0.43%	1.09%	1.64%	2.38%	1.27%	1.99%	2.80%
OECD	0.15%	0.28%	0.34%	0.30%	0.44%	0.70%	0.45%	0.72%	1.04%

The changes in real GDP after imposing a liberalization policy, in percent. *EU* stands for the sum of all the members of the EU, *OECD* is the sum of all OECD countries.

The liberalization of trade benefits both the US and the EU, both parties gain in terms of the natives' welfare and real GDP at the level of about: 0.4%.[26]. The non-EU countries would slightly lose due to such a policy, because of the multilateral resistance to trade.[27] However, the positive price spillover affects all the economies in the system, minimizing the potential losses from lower exports in the non-EU economies. All in all, the gains from liberalizing trade are positive for both the EU and the US, keeping the former slightly better off. Our simulations forecast that the monetary gains are between $40 bln and $90 bln in one year. Apparently, these numbers are smaller than the estimates by European Commission.

On the contrary, the liberalization of migration between the EU and the US brings severe losses for the European countries and substantial gains for the US economy. A tremendous increase in (mainly high-skilled) emigration to the US from the English speaking (especially Ireland and Great Britain) and the Central European countries

[24]For more information, see the full report by CEPR: $http://trade.ec.europa.eu/doclib/docs/2013/march/tradoc\_150737.pdf$ and the memo by EC: $http://europa.eu/rapid/press-release_MEMO-13-211\_en.htm$

[25]Expressed as the changes in nominal GDP, these gains equal 1% for EU and 0.8% for the US.

[26]Ireland is affected the most: 2.26% in real wage index, on average in the EU: 0.03% in welfare, in the US: 0.77%

[27]An increase in the bilateral relative attractiveness between EU and US decreases the relative attractiveness of other OECD countries which directly causes a drop in the value of trade between EU, US and the rest of OECD.

(Poland, Hungary, Slovakia), results in drops in both welfare (about -0.8%) and real GDP (from -3% to even -5% for Ireland). In general, the losses encountered in the EU due to migration liberalization outrage 4 times the gains from liberalizing trade. Therefore, the sum of both effects is substantially negative for the EU (-1.26% in terms of the real GDP) and positive for the US (1.99%).

The current migration barriers actually prevent some European countries from bearing huge losses in their stock of low-skilled workers and highly skilled specialists. This conclusion is the main argument for the European authorities against reducing migration barriers to the US. Consequently, there are still some profits to be gained from decreasing (the already small) trade restrictions between the EU and the US.

4.5 Integration between EU and Turkey

The European Union has recently revealed the political will to expand and suggested cooperation and membership to some eastern-European countries i.e. the Balkan states (Croatia successfully joined the EU in July 2013) or Turkey. The latter economy is large enough (produces 1% of OECD's value added) to provide a visible effect on European's welfare and GDP through the trade links. Consequently, the emigration from Turkey to western Europe is significant (especially in Germany where the population of Turkish immigrants is the most numerous), which also raises the question of potential gains and losses from further liberalization of migration. The aggregated results are presented in Table 10.

Table 10: Aggregated gains from liberalizing trade and migration between EU and Turkey

	Trade			Migration			Trade and Migration		
	MIN	MID	MAX	MIN	MID	MAX	MIN	MID	MAX
EU	0.02%	0.03%	0.04%	0.32%	0.47%	0.82%	0.34%	0.49%	0.84%
TUR	0.72%	1.36%	1.64%	-2.40%	-3.37%	-5.71%	-1.65%	-1.93%	-3.92%
OECD	0.01%	0.02%	0.03%	0.05%	0.08%	0.14%	0.06%	0.10%	0.16%

The changes in real GDP after imposing a liberalization policy, in percent. *EU* stands for the sum of all the members of the EU, *OECD* is the sum of all OECD countries.

The reduction of trade barriers raises the real GDP and welfare in Turkey by over 1.36% in the medium scenario. The EU countries gain only symbolically, 0.03%. This policy has almost no effect on the aggregated real GDP level in the OECD economies.

What is crucial, is the extent to which Turkey may lose after imposing the free labor mobility agreement with the EU. The losses in terms of real GDP range from -2.40% to -5.71%. The welfare of Turkish natives drops by -0.65% in the medium scenario and -1.10% in the maximal scenario. In contrast, the EU states gain a lot (in sum 0.47% in real GDP) due to larger immigration of both low and high-skilled Turks. Countries like Austria, Belgium, Germany and the Netherlands may expect the highest inflows of (mainly) low-skilled labor.

In sum, the simultaneous liberalization of trade and migration between EU and Turkey is strongly negative for the latter, with only small welfare benefits for the EU. Therefore, as freeing trade may be considered as a desired political goal, the free mobility of workers to EU appears to have disastrous consequences for the natives in Turkey.

4.6 Relations between trade and migration

The final question asked in the paper concerns potential relations between trade and migration. It is investigated whether migration is a substitute for trade (so that the flows of migrants actually decrease the bilateral trade flows - either imports or exports) or if these two processes are complements (in a sense that higher migration flows imply higher trade flows - between two particular countries). The literature does not provide a clear-cut solution to this issue. Depending on the assumptions and model structure both situations are possible.

The classical economic analysis (i.e. Heckscher-Ohlin model of international factor movement) puts forward the conjecture that mobility of different factors is substitutive.[28] Given that there are no international barriers, trade, migration and capital flows cause the international equalization of prices, wages and rents which in turn results in decreasing the incentives for factor mobility. What the the two-factor model by Heckscher and Ohlin suggests is that the trade in commodities between countries with different factor endowments is in fact an indirect factor trade. The Heckscher-Ohlin-Vanek proposition says that the country's export is intensive in the products manufactured using abundant factors, whereas the products created using scarce factors are mainly imported. Therefore, the indirect trade in factors of production (like migration or FDI) results in the equalization of differences in factor abundance between countries, which, in line, leads to factor price convergence and reduces trade.

On the contrary, Markusen (1983) proves that migration and trade may be complementary in a system of two economies with different technology endowments. In terms of empirical research, there is a rich literature that supports the conjecture that migration and trade are rather complements. The problem is analyzed taking into consideration three potential mechanisms: information, preference and network channels. Gould (1994) was first to address this question in a quantitative way. He analyzed the impact of both preference and information channels on the US imports and exports.[29] This paper, as well as other in the field, emphasizes the role of migration in creating the bilateral trade between sending and receiving countries (both imports and exports). What the authors underline, are the network and preference channels, which help to establish the informal links between the trading partners.[30]

The proposed general equilibrium model allows to formulate a firm answer to the question about the relations between migration and trade in a framework, in which there is no endogeneity problem. In fact, one is able to study two types of processes: the reaction of bilateral migration to liberalization of trade cost and the reaction of bilateral trade to liberalization of migration cost. These two exercises comprise of shocks (either to trade or migration costs) that are exogenous and influence directly only one of the two phenomena. Therefore, in what follows, we quantify the direction and the magnitude of relations between bilateral migration and bilateral trade caused by independent shocks on barriers. Due to the fact that both trade and migration are endogenous in the analyzed model, both

[28] In the stronger, quantitative sense, which implies its weaker form: through the convergence of factor prices.

[29] Similar studies (for different countries) were conducted by, inter alia, Head and Ries (1998) and Wagner et al. (2002) for Canadian provinces, Combes et al. (2005) for French regions, Tai (2009) for Switzerland, Bruder (2004) for Germany. Genc et al. (2011) conduct a meta-analysis.

[30] As Gaston and Nelson (2013) summarize the hitherto findings: "there is strong and consistent support for immigration having a positive effect on trade. [...] However, because these analyses are never carried out in the context of a structural analysis that permits an evaluation of the relative price effects that drive the general equilibrium analysis standard in the trade theoretic accounts, these results neither permit comparison with the trade theoretic claims, nor do they speak directly (or unambiguously) to the issues of whether trade and migration are substitutes or complements."

matrices with these country-pair-specific variables are driven only by the general equilibrium forces in the system of OECD countries.

In Table 11 the changes in shares of trade (either imports or exports) are regressed on the changes in the shares of migration between two countries, assuming two different types of shocks: exogenous migration liberalization (in column one and two) and exogenous trade liberalization (in column three and four).

Table 11: Regressions of Changes in Trade Share on Changes in Migration Share

	Migration liberalization		Trade liberalization	
Dependent variable:	Trade from i to j	Trade from j to i	Trade from i to j	Trade from j to i
Low-skilled from i to j	0.08^{***}	0.06^{***}	-15.88^{***}	-11.57^{***}
	(0.005)	(0.005)	(0.504)	(0.597)
R^2	0.20	0.09	0.46	0.25
High-skilled from i to j	0.03^{***}	0.02^{***}	-10.91^{***}	-8.15^{***}
	(0.003)	(0.003)	(0.307)	(0.374)
R^2	0.13	0.06	0.52	0.29

The table shows the OLS estimates of regressions: $\Delta Trade_{ij(ji)} = \beta_0 + \beta_1 \Delta Migration_{ij}$, where $\Delta Trade_{ij}$ is the change in the share of trade from country j to country i to the total GDP in country i in percentage points, and $\Delta Migration_{ij}$ is the change in the share of immigrants from country j in country i to the population in country i, in percentage points. The regressions are run separately for low and high-skilled workers. Standard errors in parenthesis.

Considering the first two columns, migration and trade seem to be complementary, which confirms the recent empirical findings. The change in share of bilateral trade (both imports and exports) is positively related to the change in the share of immigration of either low or high-skilled workers. The mechanism which causes such results works through the market size effect of migration. An inflow of people automatically increases the internal demand, so imports go up. Naturally, higher stock of workers creates the pressure on the wages, so that in the general equilibrium the wage index in receiving country goes down. This gives positive profits for the firms, which have to be zeroed by a fall in prices. In such a way, the receiving economy is more competitive, so that exports from this country increases. On the contrary, an outflow of people reduces the market size in the sending country, which decreases imports. Lower supply of workers means higher wages and higher prices, which translates into lower exports. Therefore, there is a direct chain of consequences that leads to a simultaneous movement of net immigration and both imports and exports. Reducing the migration costs, and keeping the trade costs constant, flows of goods follow flows of people, which is driven by the market size effect transmitted through the price indexes.

In contrast, the third and fourth columns of Table 11 suggest that trade and migration are rather substitutes (bilateral migration decreases with trade). Imposing a liberalization of bilateral trade barrier (for the sake of clarity, assume that the cost of trade from country i to country j decreases, keeping everything else constant) provides a positive price shock in country j (P_j decreases). In the equilibrium, this results in the entries of new firms and lower nominal wages W_j, so that the zero-profit condition holds. On the contrary, the price index in country i increases, which is mainly due to an increase in nominal wages. The latter raise because lower export

costs induce positive profits for the firms. This positive shock has to be counterbalanced in the equilibrium by higher labor cost. Generically, both countries are winning, however it is ambiguous which one is the relatively better off.[31] Assume that j benefits more in terms of the real wage gain. The general equilibrium processes concerning the simultaneous movements of migration and trade are as follows. The "winning" country j would certainly experience an inflow of new migrants from all destinations and a decrease in its emigration to all other countries. However, the effects on trade are going to be counter-directional: bilateral exports are going to increase (higher market size and competitiveness) and bilateral imports are going to decrease (for all countries except i, which increases massively, because of the multilateral resistance to trade). Therefore, higher exports is followed by lower emigration and lower imports is followed by higher immigration. All of these processes are quantitatively important. In country i, which also wins in terms of welfare, but less than country j, one can observe a moderate effect on trade and migration, except from the ones from and to country j. Now, immigration to i is positive and country i imports more and emigration from i decreases in line with a decrease in exports to all the countries except country j (once again due to the multilateral resistance). However, these two effects are rather weak.

Apparently, the positive consequences of liberalizing trade for the less opened countries are significantly greater. Thus, assuming a full trade liberalization, the general equilibrium forces that drive the counter-directional flows of goods and workers are strongly dominant. This results in the negative dependences depicted in columns three and four in Table (11). The proposed explanation can be indirectly linked with the original Heckscher-Ohlin interpretation about substitutability of productive inputs. However, our results provide some doubts to the commonly accepted conjecture that migration and trade are complements. Therefore, the only clear-cut result from this simulation is the following. The relations between trade and migration depend not only on the global assumptions of the general equilibrium model (as it is highlighted in the literature), but also on the type of exogenous shock that is imposed in the system of economies. In the case of the proposed model, the connections between both migration and trade differ significantly when imposing shocks to migration barriers (complementarity) or trade restrictions (substitutability).

5 Robustness checks

The following section provides some additional, verifying simulations that relate our approach to some previous works in the field. We start with taking the migration cost calculated with a help of the Gallup's Survey data on intended migration, following Docquier et al. (2012). The second robustness check takes a smaller value of the agent's elasticity of utility with respect to the real income, in line with Bertoli et al. (2013). The third one considers endogenous formation of total factor productivity (TFP) in each country, modeled as a Lucas externality, as in Aubry and Burzynski (2013).

[31] The latter relation depends on the placement of both countries in the world trade network. Mainly, the country which is less opened to trade benefits more from a unilateral trade liberalization.

5.1 Migration cost from the Gallup's Survey

In this subsection the approach by Docquier et al. (2012) is followed, in which the migration cost is calibrated using the data from Gallup's Survey. The authors propose a decomposition of the overall migration cost, which can be simplified and expressed in the following more tractable and useful manner:

$$c_{ij}^s = a_{ij}^s + b_{ij}^s - z_{ij}^s, \tag{17}$$

where a_{ij}^s represents all the formal costs of migration and b_{ij}^s stands for the bilateral, irreducible costs. The third component of the total migration cost, z_{ij}^s, which enters the definition with a negative sign, describes the non-monetary gains from migrating between countries j and i. In other words, this element represents all kinds of amenities that are available in the destination country (as a surplus or deficiency in reference to the benchmark value of $z_{jj}^s = 0 \; \forall j$, expressed as a multiplicity of the share of the real wage available in the destination country to the real wage in the source country).

By construction of the individuals' decision process, we obtain that: $c_{ij}^s \leq 1$, so that $M_{ij}^s/M_{jj}^s \geq 0$. Simultaneously, there is no lower bound on the cost of migration, in fact, when the amenities outweigh the migration costs, it is possible to get a negative migration cost: $c_{ij}^s < 0 \Leftrightarrow z_{ij}^s > a_{ij}^s + b_{ij}^s$.

What has to be quantified, is the matrix of formal migration costs for both skills $s \in \{l, h\}$, that is: $[a_{ij}^s]_{i,j \in N}$. This task can be accomplished using the data on intended international migration provided by the Gallup institute. Using the responds to the Gallup's World Poll survey, one can estimate the flows of people under the assumption that everyone who wants to migrate, is able to do so, to any potential country she/he likes.[32] In this manner all the formal migration barriers can be considered as absent, which means that the new migration cost may be defined as:

$$\tilde{c}_{ij}^s = b_{ij}^s - z_{ij}^s. \tag{18}$$

Assuming that the desired migration is performed in current economic circumstances (so that the decision whether to migrate or not is reached considering the actual economic variables describing the welfare: $w_{-i}^s/P_i \; \forall i$), the migration equation takes the following form:

$$\frac{\tilde{M}_{ij}^s}{\tilde{M}_{jj}^s} = \left(\frac{w_{-i}^s/P_i}{w_j^s/P_j} \left(1 - \tilde{c}_{ij}^s\right) \right)^{\alpha},$$

where $\tilde{M}_{ij}^s$ is the flow of intended migrants from country j to country i, assuming no formal migration barriers. It is straightforward to compute the value of migration cost due to legal restrictions: $\tilde{c}_{ij}^s$, for each skill level s and each pair of countries $i, j \in N$, simply as: $a_{ij}^s = c_{ij}^s - \tilde{c}_{ij}^s, \; \forall s \in \{l, h\}, \; \forall i, j \in N$. Consequently, the migration liberalization policy is defined in the following way. Let $\mu \in [0; 1]$ be the percent of reducible migration cost that evaporates in the counter factual scenario. Thus, μ is a parameter that reflects the extent to which the migration barriers are eliminated. The flows of people, after imposing a migration liberalization, are then:

$$\frac{M_{ij}^s}{M_{jj}^s} = \left(\frac{w_{-i}^s/P_i}{w_j^s/P_j} \left(1 - c_{ij}^s + \mu(c_{ij}^s - \tilde{c}_{ij}^s)\right) \right)^{\alpha} = \left(\frac{w_{-i}^s/P_i}{w_j^s/P_j} \left(1 - b_{ij}^s + z_{ij}^s + (\mu - 1)(a_{ij}^s)\right) \right)^{\alpha}. \tag{19}$$

[32] The Gallup World Poll survey is conducted in almost 150 countries (that represent over 93% of world's population). In each of them, the representative sample of about 1000 respondents is chosen and asked to answer a set of questions concerning the economic, social, ecological and political issues, as well as to evaluate the quality of life and well-being. In our case, we are particularly interested in the responses to the questions about peoples' preferences to emigrate and their choices of potential destination countries.

The macroeconomic results from this exercise, assuming $\mu = 0.5$, are presented in Table A6.1. The qualitative properties of these outcomes are very close to the benchmark. Still, the popular destinations are Australia, New Zealand, USA and Canada. Switzerland is gaining the most in terms of natives' welfare and population, whereas Belgium, Luxembourg, Austria and Israel are losing. The magnitude of the changes in welfare is slightly higher due to the fact that the volume of migration is bigger, especially for the countries with negative welfare effects. In terms of the aggregate welfare comparison, the outcomes actually resemble the reference results. On average, the citizens of the OECD lose 1.11% of their real wage, the college-educated are predominantly better off than the low-skilled workers.

The crucial difference between the initial approach and the one that relates on Gallup Survey is the substantial increase in migration of low-skilled people. However, in the data one can observe that intra-OECD migration is high-skilled biased. This may be the consequence of the fact that the Gallup Institute asks for the intentions to migrate, not whether the decision is actually reached. Indeed, the low-skilled may be overoptimistic about their ambitions to emigrate, and, in the end, their goal may not actually be fulfilled. On the contrary, the high-skilled have both more motivation and more (educational) resources to migrate, which decreases their migration cost and increases the probability of realizing the initially intended plan.

5.2 Alternative parametrization of agents' utility

The paper by Bertoli, Moraga and Ortega (2013) provides some insights about estimating the elasticity of utility with respect to real wage in the random utility model. The authors analyze a simple Roy model in which agents decide about locating considering the deterministic (objective) real wage and stochastic (subjective) taste for migration. This representation leads to a logit probability of migration, which then is a function of the wage rate. They estimate the core parameter (denoted by α in our model) using a nested logit model in logarithms. They find that the elasticity of utility with respect to wage ranges from 0.501 to 0.756 (depending on the estimation procedure, the reference value is 0.655).

According to the results by Bertoli et al. (2013) and our own estimations of α (see Tables A4.1 and A4.2), we decided to run an additional set of simulations assuming a lower value of the semi-elasticity of utility with respect to the real wage. In line with those findings, we take $\alpha = 0.7$. The main country-specific results are gathered in Table A6.2.

Clearly, the qualitative properties are identical to the benchmark results with $\alpha = 1$. However, the magnitudes of the effects are now somewhat different, and are characterized by lower dispersion. Indeed, the agents are now less responsive to changes in migration costs, thus less people migrate, so that both the benefits for the winners and the costs for the losers are now reduced. However, the real wage index decreases by 0.01% on average in the OECD countries, which is precisely what was obtained for the reference scenario.

5.3 The TFP effect of migration

Immigration and emigration may affect the technological performance of an economy by an inflow or outflow of professionals. Some recent findings by Peri et al. (2013) give evidence that immigration of scientists, engineers and mathematicians has a strong positive influence on the remuneration of high-skilled non-migrants in the US,

and a slight effect on the less educated. Aubry and Burzynski (2013) show that the TFP effect plays an important role in the overall welfare impact of net migration for the natives in OECD countries.

However, there are some confusing arguments about the impact of the high-skilled workers on the technological progress and productivity. On the one hand Acemoglu and Angrist (2001) do not find any relations between the share of tertiary educated workers and the economy-wide productivity. On the other hand, Moretti (2004) estimates robust social returns attributed to high-skilled workers. Therefore, we would like to account for those potential spillovers and endogenize the level of TFP in each economy. In doing so we follow Lucas (1988) and write the TFP function as a product of an exogenously given TFP residual, $\bar{A}_i$ and a concave function of the high-skilled share in population:

$$A_i = \bar{A}_i g_i^{\lambda}, \qquad g_i \equiv \frac{L_i^h + L_{-i}^h}{L_i^T}. \tag{20}$$

We arbitrary fix the elasticity of TFP with respect to the high-skilled share at the level of $\lambda = 0.3$.

The results of the robustness check including endogenous TFP levels are presented in Table A6.3. The main difference with the reference results is a larger dispersion of the quantitative effects. Indeed, the countries which win, are the ones which gain relatively more high-skilled workers. This improves the productivity of all employed and causes the nominal wages to raise. On the contrary, the losing countries are generally the ones drained from their high-skilled potential. Therefore, the losses for the natives in these economies are even more pronounced after accounting for endogenous TFP.

6 Conclusions

The paper develops a multi-country general equilibrium model which allows to quantify the welfare effects of a hypothetic decrease in the formal barriers for international migration and trade. In the benchmark scenario, the OECD economies gain 2% of their real GDP after reducing the migration barriers. However, in the sample of 34 OECD countries, there are only several winners from migration liberalization. People living in the majority of economies encounter substantial welfare losses due to an exodus of high-skilled workers and a decrease in the number of varieties consumed. Moreover, the gains from liberalizing migration are not equally distributed within the analyzed developed countries. The college educated are mainly better off, largely because of the beneficial nominal wage effect, as well as their flexibility and the capability of being more mobile then the low-skilled people.

Secondly, the paper analyzes the welfare consequences of intra OECD trade liberalization. In doing so, we set all the bilateral tariff and non-tariff trade restrictions to zero. The simulations show that the welfare effect of this policy provides a change in real GDP at the level of 1.5% for the OECD countries. In contrast to the migration liberalization, the gains from reducing trade barriers are shared by all the OECD members. Moreover, their magnitude is such that the between-country inequality reduces.

In terms of the bilateral liberalizations between EU-US and EU-Turkey, the general mechanism brings benefits for the receiving countries, whereas we observe some harmful consequences for the sending states. The impact of liberalizing migration is quantitatively more important and dominates the effect of imposing bilateral trade agreements.

Finally, analyzing the endogenous macroeconomic processes after an exogenous shock in the general equilibrium system of economies, some conclusions may be drawn about the relations between migration and trade. When the costs of labor mobility are reduced, both migration and trade increase. On the contrary, reducing bilateral tariff and non-tariff barriers spurs trade, but diminishes the stocks of migrants. Therefore, whether migration and trade are substitutes or complementaries depends not only on the assumptions of the theoretical model, but also on the type of exogenous shock one imposes in the general equilibrium system.

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Table 3: The Welfare and Demographic Effects of Migration Liberalization (MID scenario)

ISO	Change in real wage					Change in labor force			
Code	W_i/P_i	w_i^l/P_i	w_i^h/P_i	w_{-i}^l/P_i	w_{-i}^h/P_i	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h
NZL	5.14%	6.16%	3.55%	3.67%	0.89%	-0.93%	-7.21%	59.25%	56.15%
AUS	4.60%	4.32%	4.93%	2.00%	2.73%	-2.55%	-8.19%	52.80%	40.15%
CHE	3.51%	3.06%	3.97%	0.56%	0.80%	-3.05%	-9.03%	58.51%	69.17%
ISR	2.65%	2.40%	2.95%	1.33%	1.19%	-3.12%	-12.84%	19.65%	23.09%
CAN	2.24%	1.91%	2.52%	0.05%	0.74%	-2.99%	-5.80%	40.12%	33.56%
USA	1.37%	0.60%	1.84%	-1.11%	0.38%	-0.30%	-0.42%	40.49%	32.73%
IRL	0.61%	0.80%	0.40%	-2.49%	-3.55%	-13.87%	-28.58%	67.43%	59.35%
LUX	0.23%	-0.28%	0.73%	-0.60%	0.14%	-1.16%	-3.68%	5.44%	8.16%
BEL	0.06%	-0.84%	0.90%	-1.69%	0.20%	-0.66%	-2.55%	17.88%	12.17%
AUT	0.04%	-1.31%	1.43%	-2.47%	0.01%	-2.27%	-5.62%	23.69%	25.03%
SWE	0.04%	-0.52%	0.70%	-1.14%	-0.23%	-0.56%	-3.16%	12.80%	16.65%
ROW	0.00%	0.00%	0.02%	0.05%	0.44%	0.01%	-0.02%	-1.14%	-8.08%
NLD	0.00%	-1.72%	2.13%	-2.82%	1.20%	-1.99%	-7.66%	22.61%	10.90%
JPN	0.00%	-0.27%	0.27%	-1.87%	-1.58%	-0.16%	-1.28%	38.06%	43.14%
OECD	**-0.01%**	**-0.84%**	**1.02%**	**-2.11%**	**-0.71%**	**-2.91%**	**-8.00%**	**27.21%**	**31.55%**
CZE	-0.11%	-1.40%	2.23%	-3.68%	-0.33%	-1.83%	-8.42%	56.63%	52.25%
ESP	-0.11%	-0.35%	0.16%	-0.76%	-0.54%	-0.45%	-1.93%	8.11%	12.94%
NOR	-0.14%	-0.76%	0.66%	-1.61%	-0.56%	-0.81%	-4.42%	17.78%	21.98%
FRA	-0.17%	-0.59%	0.27%	-0.92%	-0.51%	-0.59%	-2.39%	6.20%	14.10%
DEU	-0.21%	-1.20%	0.93%	-2.53%	-0.36%	-1.62%	-4.79%	28.93%	23.24%
FIN	-0.29%	-0.98%	0.35%	-2.25%	-1.11%	-0.74%	-3.04%	28.57%	29.95%
EST	-0.46%	-1.36%	0.86%	-1.54%	0.11%	-4.18%	-12.23%	-0.75%	1.86%
DNK	-0.47%	-1.51%	0.88%	-2.31%	-0.14%	-0.96%	-5.00%	16.74%	16.40%
ITA	-0.77%	-1.10%	-0.34%	-1.50%	-1.26%	-2.31%	-3.83%	5.80%	15.65%
ISL	-0.85%	-2.11%	1.23%	-2.65%	0.15%	-1.96%	-10.37%	9.37%	11.17%
HUN	-1.04%	-3.37%	2.06%	-5.19%	-0.78%	-2.59%	-11.73%	42.43%	55.14%
GBR	-1.13%	-2.80%	0.63%	-4.01%	-1.75%	-4.14%	-15.56%	23.11%	36.52%
CHL	-1.15%	-2.78%	1.08%	-3.61%	-1.29%	-1.34%	-7.96%	17.27%	47.76%
TUR	-1.21%	-1.22%	-1.18%	-2.98%	-4.07%	-5.38%	-9.01%	35.53%	64.87%
KOR	-1.24%	-2.70%	0.06%	-3.07%	-2.05%	-2.23%	-7.20%	5.37%	42.03%
SVN	-1.58%	-2.72%	-0.28%	-3.16%	-1.39%	-5.89%	-10.91%	2.90%	11.38%
PRT	-1.63%	-2.54%	-0.71%	-2.82%	-1.54%	-4.36%	-7.91%	1.25%	9.06%
GRC	-1.68%	-2.55%	-0.54%	-2.94%	-1.49%	-4.53%	-8.55%	3.43%	10.64%
POL	-1.85%	-4.26%	1.58%	-5.00%	0.15%	-3.00%	-13.21%	13.11%	15.27%
SVK	-2.14%	-3.37%	-0.10%	-5.66%	-2.95%	-7.21%	-13.14%	49.97%	54.95%
MEX	-2.47%	-3.28%	-1.45%	-6.91%	-5.42%	-9.38%	-14.32%	94.81%	95.22%

The table presents changes in: real wage indexes, real wages of four types of workers and stocks of low/high-skilled natives/foreigners, after liberalizing migration (MID scenario). OECD stands for the unweighted average change in the OECD countries, ROW stands for the Rest of the World.

Table 6: The Welfare and Demographic Effects of Trade Liberalization (MID scenario)

ISO	Change in real wage					Change in labor force			
Code	W_i/P_i	w_i^l/P_i	w_i^h/P_i	w_{-i}^l/P_i	w_{-i}^h/P_i	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h
HUN	10.40%	10.58%	10.15%	10.15%	9.77%	0.26%	0.96%	8.54%	8.09%
MEX	9.26%	9.37%	9.13%	9.00%	8.79%	0.88%	1.16%	8.06%	7.65%
EST	8.33%	8.59%	7.93%	8.20%	7.61%	0.69%	1.19%	8.29%	7.43%
SVN	7.91%	7.92%	7.90%	7.56%	7.57%	0.50%	0.74%	7.55%	7.20%
NZL	7.80%	8.10%	7.34%	7.77%	7.11%	0.61%	1.49%	6.91%	5.88%
CAN	6.93%	7.04%	6.83%	6.74%	6.56%	0.21%	0.33%	6.02%	5.61%
ISL	5.72%	5.87%	5.47%	5.67%	5.33%	0.32%	0.84%	4.27%	3.57%
SVK	5.21%	5.25%	5.13%	5.17%	5.05%	0.08%	0.27%	1.64%	1.84%
CZE	4.98%	5.02%	4.90%	4.96%	4.82%	0.07%	0.23%	1.14%	1.89%
IRL	4.61%	4.77%	4.43%	4.62%	4.33%	0.74%	1.11%	3.70%	3.05%
CHE	4.39%	4.40%	4.39%	4.23%	4.25%	0.15%	0.26%	3.41%	2.97%
KOR	3.91%	3.95%	3.88%	3.76%	3.74%	0.07%	0.17%	3.72%	2.86%
OECD	**3.30%**	**3.34%**	**3.24%**	**3.23%**	**3.16%**	**0.12%**	**0.23%**	**2.21%**	**1.94%**
ISR	3.27%	3.34%	3.19%	3.20%	3.08%	0.11%	0.30%	2.73%	2.51%
CHL	3.07%	3.07%	3.06%	2.94%	2.96%	0.04%	0.06%	2.68%	2.06%
POL	2.98%	3.00%	2.94%	2.86%	2.83%	0.05%	0.13%	2.66%	2.45%
NOR	2.83%	2.84%	2.82%	2.75%	2.75%	0.04%	0.07%	1.87%	1.44%
AUS	2.51%	2.54%	2.48%	2.48%	2.42%	0.01%	0.02%	1.25%	1.08%
BEL	2.25%	2.23%	2.28%	2.16%	2.22%	0.05%	0.03%	1.34%	1.23%
NLD	2.08%	2.06%	2.11%	1.99%	2.05%	-0.02%	-0.09%	1.34%	1.18%
SWE	1.84%	1.83%	1.84%	1.80%	1.82%	0.01%	0.00%	0.68%	0.55%
TUR	1.58%	1.58%	1.57%	1.51%	1.52%	0.02%	0.01%	1.41%	0.97%
JPN	1.28%	1.28%	1.28%	1.30%	1.30%	0.00%	0.00%	-0.41%	-0.32%
FIN	1.21%	1.21%	1.22%	1.27%	1.29%	-0.05%	-0.07%	-1.37%	-1.42%
USA	1.17%	1.25%	1.12%	1.36%	1.14%	-0.01%	-0.01%	-2.09%	-0.38%
DEU	1.13%	1.12%	1.14%	1.12%	1.14%	-0.03%	-0.06%	0.06%	0.04%
DNK	1.02%	1.00%	1.05%	0.99%	1.06%	-0.04%	-0.11%	0.07%	-0.27%
AUT	0.95%	0.94%	0.97%	0.96%	1.00%	-0.06%	-0.11%	-0.46%	-0.81%
GBR	0.81%	0.74%	0.89%	0.74%	0.88%	-0.11%	-0.42%	-0.15%	-0.19%
FRA	0.62%	0.60%	0.64%	0.60%	0.64%	-0.02%	-0.06%	0.13%	-0.22%
ITA	0.59%	0.58%	0.60%	0.57%	0.60%	-0.09%	-0.09%	0.28%	-0.23%
LUX	0.55%	0.52%	0.58%	0.53%	0.61%	-0.11%	-0.13%	-0.33%	-0.76%
ESP	0.40%	0.38%	0.41%	0.38%	0.43%	-0.02%	-0.05%	-0.02%	-0.40%
PRT	0.33%	0.30%	0.35%	0.28%	0.36%	-0.19%	-0.27%	0.15%	-0.38%
GRC	0.28%	0.26%	0.31%	0.24%	0.31%	-0.14%	-0.21%	0.13%	-0.23%
ROW	-0.09%	-0.12%	-0.03%	-0.04%	0.05%	-0.02%	-0.17%	-1.56%	-1.82%

The table presents changes in: real wage indexes, real wages of four types of workers and stocks of low/high-skilled natives/foreigners, after liberalizing trade (MID scenario). OECD stands for the unweighted average change in the OECD countries, ROW stands for the Rest of the World.

Table 8: The Welfare and Demographic Effects of Migration and Trade Liberalization (MID scenario)

ISO	Change in real wage					Change in labor force			
Code	W_i/P_i	w_i^l/P_i	w_i^h/P_i	w_{-i}^l/P_i	w_{-i}^h/P_i	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h
NZL	13.13%	14.54%	10.96%	11.54%	7.92%	-0.27%	-5.61%	69.50%	64.51%
HUN	9.45%	7.20%	12.45%	4.78%	9.00%	-2.14%	-10.25%	54.58%	67.41%
CAN	9.31%	9.09%	9.50%	6.82%	7.36%	-2.64%	-5.21%	48.21%	40.65%
CHE	7.90%	7.45%	8.36%	4.69%	4.94%	-2.82%	-8.67%	63.45%	73.68%
EST	7.87%	7.22%	8.84%	6.65%	7.74%	-3.28%	-10.76%	7.57%	9.41%
MEX	7.45%	6.78%	8.30%	2.42%	3.64%	-7.86%	-12.37%	111.88%	111.28%
AUS	7.09%	6.82%	7.42%	4.38%	5.13%	-2.55%	-8.18%	54.51%	41.30%
SVN	6.50%	5.33%	7.81%	4.51%	6.31%	-5.11%	-9.77%	10.94%	19.49%
ISR	5.92%	5.75%	6.12%	4.53%	4.22%	-2.97%	-12.48%	22.44%	25.78%
IRL	5.40%	5.77%	5.01%	2.18%	0.81%	-12.86%	-27.38%	73.74%	64.07%
ISL	4.93%	3.78%	6.81%	3.02%	5.56%	-1.56%	-9.35%	13.86%	14.86%
CZE	4.83%	3.54%	7.17%	1.12%	4.42%	-1.70%	-8.06%	57.69%	54.46%
OECD	**3.34%**	**2.53%**	**4.33%**	**1.11%**	**2.46%**	**-2.75%**	**-7.70%**	**29.94%**	**34.03%**
SVK	3.17%	1.95%	5.19%	-0.52%	2.12%	-7.05%	-12.70%	52.01%	57.68%
KOR	2.79%	1.34%	4.08%	0.78%	1.76%	-2.11%	-6.88%	9.38%	45.98%
NOR	2.68%	2.06%	3.48%	1.10%	2.17%	-0.77%	-4.32%	19.74%	23.50%
USA	2.47%	1.83%	2.86%	0.24%	1.44%	-0.32%	-0.44%	36.37%	31.49%
BEL	2.34%	1.39%	3.23%	0.47%	2.45%	-0.61%	-2.53%	19.24%	13.37%
NLD	2.10%	0.31%	4.32%	-0.86%	3.30%	-2.04%	-7.84%	23.96%	12.06%
CHL	1.94%	0.27%	4.24%	-0.71%	1.72%	-1.30%	-7.91%	20.19%	50.31%
SWE	1.85%	1.28%	2.54%	0.63%	1.57%	-0.56%	-3.17%	13.24%	16.95%
JPN	1.29%	1.03%	1.57%	-0.55%	-0.26%	-0.16%	-1.28%	36.65%	42.11%
POL	1.17%	-1.28%	4.66%	-2.16%	3.07%	-2.92%	-13.03%	16.05%	18.02%
AUT	0.96%	-0.42%	2.37%	-1.54%	1.00%	-2.38%	-5.82%	22.46%	23.49%
FIN	0.91%	0.21%	1.58%	-0.98%	0.19%	-0.80%	-3.16%	25.93%	27.57%
DEU	0.91%	-0.10%	2.09%	-1.44%	0.79%	-1.67%	-4.90%	28.65%	22.95%
LUX	0.77%	0.22%	1.29%	-0.09%	0.74%	-1.30%	-3.86%	4.91%	7.19%
DNK	0.54%	-0.54%	1.95%	-1.35%	0.93%	-1.02%	-5.18%	16.57%	15.92%
FRA	0.44%	-0.01%	0.92%	-0.34%	0.15%	-0.62%	-2.50%	6.15%	13.59%
TUR	0.39%	0.38%	0.41%	-1.47%	-2.56%	-5.36%	-8.99%	37.15%	65.98%
ESP	0.27%	0.01%	0.58%	-0.40%	-0.10%	-0.49%	-2.01%	7.89%	12.21%
ROW	-0.08%	-0.12%	-0.02%	0.01%	0.49%	0.00%	-0.19%	-2.70%	-9.74%
ITA	-0.19%	-0.54%	0.25%	-0.95%	-0.65%	-2.46%	-4.00%	5.89%	15.12%
GBR	-0.34%	-2.13%	1.56%	-3.34%	-0.86%	-4.34%	-16.15%	22.51%	35.96%
PRT	-1.34%	-2.30%	-0.37%	-2.59%	-1.21%	-4.68%	-8.34%	1.27%	8.44%
GRC	-1.43%	-2.34%	-0.25%	-2.74%	-1.19%	-4.75%	-8.88%	3.38%	10.17%

The table presents changes in: real wage indexes, real wages of four types of workers and stocks of low/high-skilled natives/foreigners, after liberalizing migration and trade (MID scenario). OECD stands for the unweighted average change in the OECD countries, ROW stands for the Rest of the World.

Appendix 1

The detailed description of the theoretical model may be found in Aubry, Burzynski (2013). In what follows, we summarize the main equations of the model.

Preferences and demand

Individuals solve their utility maximization problem:

$$\max_{x^s_{ijh}(k)} \left\{ \alpha \ln \left[\left(1 - c^s_{ij}\right) \left(\sum_{h=1}^{N} \int_0^{B_h} x^s_{ijh}(k)^{\frac{\epsilon-1}{\epsilon}} dk \right)^{\frac{\epsilon}{\epsilon-1}} \right] + \varepsilon_{ij} \right\} \tag{A1.1}$$

under the budget constraint:

$$\sum_{h=1}^{N} \int_0^{B_h} p_{ih}(k) \cdot x^s_{ijh}(k) dk = w^s_{ij}, \qquad \text{where:} \quad w^s_{ij} = \begin{cases} w^s_i & \text{if} \quad j = i \\ w^s_{-i} & \text{if} \quad j \neq i \end{cases} \tag{A1.2}$$

The solution, that is the individual demand function, boils down to:

$$x_{ijh}(k) = \frac{p_{ih}(k)^{-\epsilon}}{\sum_{h=1}^{N} B_h \left(\tau_{ih} p_h\right)^{1-\epsilon}} X_i. \tag{A1.3}$$

Solving for the indirect utility function:

$$U^s_{ij} = \alpha \ln \left[\left(1 - c^s_{ij}\right) u^s_{ij} \right] + \varepsilon_{ij} \tag{A1.4}$$

where:

$$u^s_{ij} = \left(\sum_{h=1}^{N} \int_0^{B_h} \left(\frac{p_{ih}(k)^{-\epsilon}}{P_i^{1-\epsilon}} w^s_{ij} \right)^{\frac{\epsilon-1}{\epsilon}} dk \right)^{\frac{\epsilon}{\epsilon-1}} = \frac{w^s_{ij}}{P_i} \tag{A1.5}$$

Production

The production function of firm k in country i is defined as a nested CES function of employed labor. The upper level production function determines the quantity of efficient high-skilled and low-skilled components needed to produce a given output $y_i(k)$:

$$y_i(k) = A_i \bar{\ell}^T_i(k) = A_i \left(\theta^S_i \left(\bar{\ell}^h_i(k) \right)^{\frac{\sigma_S - 1}{\sigma_S}} + \left(1 - \theta^S_i\right) \left(\bar{\ell}^l_i(k) \right)^{\frac{\sigma_S - 1}{\sigma_S}} \right)^{\frac{\sigma_S}{\sigma_S - 1}}, \tag{A1.6}$$

where A_i is the exogenous country-specific level of total factor productivity (in the robustness check it is modeled endogenously as a Lucas externality, so that: $A_i = \bar{A}_i g_i^{\lambda},\ g_i \equiv \left(L^h_i + L^h_{-i}\right) / L^T_i$[33]).

The lower level production functions define the efficient labor composits for each level of education, as a CES combinations of native and foreign workers:

$$\begin{aligned} \bar{\ell}^l_i(k) &= \left[\theta^N_i \left(\ell^l_i(k) \right)^{\frac{\sigma_N - 1}{\sigma_N}} + \left(1 - \theta^N_i\right) \left(\ell^l_{-i}(k) \right)^{\frac{\sigma_N - 1}{\sigma_N}} \right]^{\frac{\sigma_N}{\sigma_N - 1}}, \\ \bar{\ell}^h_i(k) &= \left[\theta^N_i \left(\ell^h_i(k) \right)^{\frac{\sigma_N - 1}{\sigma_N}} + \left(1 - \theta^N_i\right) \left(\ell^h_{-i}(k) \right)^{\frac{\sigma_N - 1}{\sigma_N}} \right]^{\frac{\sigma_N}{\sigma_N - 1}}. \end{aligned} \tag{A1.7}$$

[33] Consider the following notation for $s \in \{l, h\}$: ℓ^s_i and ℓ^s_{-i} are the numbers of native and foreign workers of skill s employed by firms in country i, so the total firms' demand for workers in country i is: $\ell^T_i = \ell^l_i + \ell^h_i + \ell^l_{-i} + \ell^h_{-i}$

Firstly, for a given production level $y_i(k)$, each firm chooses the optimal combination of high-skilled and low-skilled efficient composits, that minimizes the total labor cost:

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

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

The first-order conditions determine the optimal demand for efficient low and high-skilled workers in firm k:

$$\bar{\ell}_i^h(k) = \frac{y_i(k)}{A_i} \left(\frac{\theta_i^S W_i}{W_i^h} \right)^{\sigma_S} \qquad \text{and} \qquad \bar{\ell}_i^l(k) = \frac{y_i(k)}{A_i} \left(\frac{(1-\theta_i^S) W_i}{W_i^l} \right)^{\sigma_S}, \tag{A1.8}$$

where W_i is the aggregate wage index and is defined as:

$$W_i = \left[\left(\theta_i^S\right)^{\sigma_S} \left(W_i^h\right)^{1-\sigma_S} + (1-\theta_i^S)^{\sigma_S} \left(W_i^l\right)^{1-\sigma_S} \right]^{\frac{1}{1-\sigma_S}}. \tag{A1.9}$$

Secondly, each firm chooses the optimal combination of native and foreign workers within each education category, taking the total supply of efficient high and low-skilled labor as given. Firms solve the following cost minimization for high-skilled workers:

$$\min_{\ell_i^h(k),\ell_{-i}^h(k)} w_i^h \ell_i^h(k) + w_{-i}^h \ell_{-i}^h(k)$$

subject to:

$$s.t.\ \left(\theta_i^N \left(\ell_i^h(k) \right)^{\frac{\sigma_N - 1}{\sigma_N}} + \left(1 - \theta_i^N\right) \left(\ell_{-i}^h(k) \right)^{\frac{\sigma_N - 1}{\sigma_N}} \right)^{\frac{\sigma_N}{\sigma_N - 1}} \geq \bar{\ell}_i^h(k).$$

The optimal labor demands for skilled natives and migrants are then equal to:

$$\ell_i^h(k) \;=\; \bar{\ell}_i^h(k) \left(\frac{\theta_i^N W_i^h}{w_i^h} \right)^{\sigma_N} = \frac{y_i(k)}{A_i} \left(\frac{\theta_i^S W_i}{W_i^h} \right)^{\sigma_S} \left(\frac{\theta_i^N W_i^h}{w_i^h} \right)^{\sigma_N} \tag{A1.10}$$

and

$$\ell_{-i}^h(k) \;=\; \bar{\ell}_i^h(k) \left(\frac{(1-\theta_i^N) W_i^h}{w_{-i}^h} \right)^{\sigma_N} = \frac{y_i(k)}{A_i} \left(\frac{\theta_i^S W_i}{W_i^h} \right)^{\sigma_S} \left(\frac{(1-\theta_i^N) W_i^h}{w_{-i}^h} \right)^{\sigma_N}$$

where W_i^h is the remuneration of the efficient high-skilled labor composite:

$$W_i^h = \left[\left(\theta_i^N\right)^{\sigma_N} \left(w_i^h\right)^{1-\sigma_N} + \left(1-\theta_i^N\right)^{\sigma_N} \left(w_{-i}^h\right)^{1-\sigma_N} \right]^{\frac{1}{1-\sigma_N}}. \tag{A1.11}$$

Labor demand and wage index for the low-skilled natives and migrants are derived in a symmetric way. The homogeneity of firms induces that the firm-specific indicators, k, may be dropped. The above described cost minimization problem determines the optimal unit cost of production for each firm:

$$c_i = \frac{w_i^h \ell_i^h + w_{-i}^h \ell_{-i}^h + w_i^l \ell_i^l + w_{-i}^l \ell_{-i}^l}{y_i} = \frac{W_i}{A_i}. \tag{A1.12}$$

The firm's profit maximization determines the price and quantity produced per firm. Each firm faces a residual demand curve with a constant elasticity of substitution equal to ϵ and then chooses the same markup $\epsilon/(\epsilon-1)$ which yields the following pricing rule:

$$p_i = \frac{\epsilon}{\epsilon - 1} c_i = \frac{\epsilon}{\epsilon - 1} \frac{W_i}{A_i}. \tag{A1.13}$$

The output per firm, y_i, is determined by the profit maximization and the free entry condition. Indeed, as long as the profits are positive, new firms will enter the market causing profits to fall, until they are driven to zero:

$$\pi = (p_i - c_i)\, y_i - W_i f_i = 0, \tag{A1.14}$$

so that:

$$y_i = (\epsilon - 1) A_i f_i. \tag{A1.15}$$

The mass of varieties B_i produced in economy i is a function of country size. Notice that the total production in economy i is $B_i y_i$, therefore:

$$B_i y_i = B_i A_i \bar{\ell}_i^T = \tfrac{\epsilon-1}{\epsilon} A_i \bar{L}_i^T = B_i (\epsilon - 1) A_i f_i,$$

because only the share $\frac{\epsilon-1}{\epsilon}$ of total labor $\bar{L}_i^T$ is devoted to the production purposes (that is: $\bar{\ell}_i^T$), the rest is employed to cover the fixed costs. The mass of varieties produced in a given country is then equal to:

$$B_i = \frac{\bar{L}_i^T}{\epsilon f_i}. \tag{A1.16}$$

Aggregating the country-pair-specific flows of goods one obtains a simple representation of export from country j to country i, as a share of the domestic GDP:

$$\frac{X_{ij}}{X_j} = \frac{X_i \left(P_i / \tau_{ij}\right)^{\epsilon-1}}{\sum_{h=1}^{N} X_h \left(P_h / \tau_{hj}\right)^{\epsilon-1}}. \tag{A1.17}$$

Migration

Using the explicit form of the utility:

$$U_{ij}^s = \alpha \ln \left[\left(1 - c_{ij}^s\right) \frac{w_{ij}^s}{P_i} \right] + \varepsilon_{ij}, \tag{A1.18}$$

and assuming that $\varepsilon_{ij} \sim EVD(0,1)$, we apply the McFadden's theorem (see McFadden, 1984) to calculate the probability that an aget of type s will emigrate from country j to country i:

$$\pi_{ij}^s = \Pr[U_{ij}^s = \max_{k \in N} \left(U_{kj}^s\right)] = \frac{\exp\left(U_{ij}^s - \varepsilon_{ij}\right)}{\sum_{k=1}^{N} \exp\left(U_{kj}^s - \varepsilon_{ij}\right)} = \frac{\left((1 - c_{ij}^s) w_{ij}^s / P_i\right)^{\alpha}}{\sum_{k=1}^{N} \left((1 - c_{kj}^s) w_{kj}^s / P_k\right)^{\alpha}}. \tag{A1.19}$$

Knowing that for $j \neq i$:

$$\pi_{ij}^s = \frac{M_{ij}^s}{L_j^T} = \frac{\left((1 - c_{ij}^s) w_{-i}^s / P_i\right)^{\alpha}}{\sum_{k=1}^{N} \left((1 - c_{kj}^s) w_{kj}^s / P_k\right)^{\alpha}}, \tag{A1.20}$$

and for $i = j$:

$$\pi_{jj}^s = \frac{M_{jj}^s}{L_j^T} = \frac{\left(w_j^s / P_j\right)^{\alpha}}{\sum_{k=1}^{N} \left((1 - c_{kj}^s) w_{kj}^s / P_k\right)^{\alpha}}, \tag{A1.21}$$

we obtain the random utility model equations, which define the endogenous flows of people:

$$\frac{M_{ij}^s}{M_{jj}^s} = \frac{\pi_{ij}^s}{\pi_{jj}^s} = \left(\frac{w^s{}_{-i} / P_i}{w_j^s / P_j} \left(1 - c_{ij}^s\right) \right)^{\alpha}. \tag{A1.22}$$

Competitive equilibrium

The competitive equilibrium is a set $\{w_i^s, w_{-i}^s, W_i, W_i^h, W_i^l, c_i, p_i, P_i, B_i, [X_{ij}]_{i,j\in N}, [M_{ij}^s]_{i,j\in N}\}_{i\in N}$ such that for a set of common parameters $\{\epsilon, \sigma_S, \sigma_N, \alpha\}$, a set of country-specific parameters $\{\theta_i^S, \theta_i^N, L_i^s, f_i, A_i\}_{i\in N}$ and the matrixes of country-pair trade costs $[\tau_{ij}]_{i,j\in N}$ and migration costs $[c_{ij}^s]_{i,j\in N}$, $s \in \{l, h\}$:

1. Each vector of nominal wages in $i \in N$: $w_i^l, w_i^h, w_{-i}^l, w_{-i}^h$ is determined by four labor market clearing conditions:
$$\begin{aligned} L_i^l &= \bar{L}_i^T (1-\theta_i^S)^{\sigma_S} \left(\theta_i^M\right)^{\sigma_M} (W_i)^{\sigma_S} \left(W_i^l\right)^{\sigma_M-\sigma_S} (w_i^l)^{-\sigma_M}, \\ L_i^h &= \bar{L}_i^T \left(\theta_i^S\right)^{\sigma_S} \left(\theta_i^M\right)^{\sigma_M} (W_i)^{\sigma_S} \left(W_i^h\right)^{\sigma_M-\sigma_S} \left(w_i^h\right)^{-\sigma_M}, \\ L_{-i}^l &= \bar{L}_i^T (1-\theta_i^S)^{\sigma_S} (1-\theta_i^M)^{\sigma_M} (W_i)^{\sigma_S} \left(W_i^l\right)^{\sigma_M-\sigma_S} (w_{-i}^l)^{-\sigma_M}, \\ L_{-i}^h &= \bar{L}_i^T \left(\theta_i^S\right)^{\sigma_S} (1-\theta_i^M)^{\sigma_M} (W_i)^{\sigma_S} \left(W_i^h\right)^{\sigma_M-\sigma_S} (w_{-i}^h)^{-\sigma_M}, \end{aligned} \tag{A1.23}$$
where $L_i^l, L_i^h, L_{-i}^l, L_{-i}^h$ are the exogenous quantities of labor in country i.
2. The zero profit condition pins down the wage index: W_i for $i \in N$.
3. The equilibrium wages and the wage indexes determine: $\{W_i^h, W_i^l, c_i, p_i\}$.
4. The mass of varieties is determined by the market size equation.
5. The mass of varieties, the wage indexes and the bilateral trade costs $[\tau_{ij}]_{i,j\in N}$, determine P_i.
6. The trade matrix $[X_{ij}]_{i,j\in N}$ is determined by the trade gravity equation.
7. The migration matrices $[M_{ij}]_{i,j\in N}$ are determined by the bilateral migration costs $[c_{ij}]_{i,j\in N}$ and the random utility model equations.

Appendix 2

Consider a standard log utility:

$$U_{ij}^s = \ln \frac{w_{-i}^s}{P_i} + \ln(1-c_{ij}^s) + \epsilon_i \equiv u_{ij} + \epsilon_{ij}, \qquad i \neq j, \tag{A2.1}$$

$$U_{jj}^s = \ln \frac{w_j^s}{P_j} + \epsilon_{jj} \equiv u_{jj} + \epsilon_{jj}, \qquad i = j, \tag{A2.2}$$

where $\epsilon_{ij} \sim EVD(0, \sigma)$ are $i.i.d.$ and σ is the scale parameter of the Type I EVD (called the Gumbel distribution). For the sake of clarity let us consider the choice problem of an individual living in country $j = 1$. Assume also that there are only two possible destinations $N = \{1, 2\}$. The following argument can be easily extended to the case where $|N| > 2$.

Assuming that $\mathbb{E}[\epsilon] = 0$, we get that:

$$\Pr[\epsilon < x] \equiv F(x) = \exp(-\exp(-(x/\sigma))). \tag{A2.3}$$

so the probability density function is given by:

$$f(x) = \frac{1}{\sigma} \exp(-x/\sigma) \exp(-\exp(-(x/\sigma))) \tag{A2.4}$$

Consider the probability that an individual in country i chooses to stay in i. By the assumption of independence between the random components, we obtain:

$$\Pr\left[U_{11} > U_{21}\right] = \Pr\left[u_{11} + \epsilon_{11} > u_{21} + \epsilon_{21}\right] = \int_{-\infty}^{\infty} f(\epsilon_1) \left(\int_{-\infty}^{\epsilon_{11}+u_{11}-u_{21}} f(\epsilon_{21}) d\epsilon_{21} \right) d\epsilon_{11} \tag{A2.5}$$

The inner integral can be simply calculated as:

$$\int_{-\infty}^{\epsilon_{11}+u_{11}-u_{21}} f(\epsilon_{21}) d\epsilon_{21} = F(\epsilon_{11} + u_{11} - u_{21}) = \exp\left(-\exp\left(-\frac{\epsilon_{11} + u_{11} - u_{21}}{\sigma} \right) \right)$$

Therefore:

$$\begin{aligned}
\Pr\left[U_{11} > U_{21}\right] =& \frac{1}{\sigma} \int_{-\infty}^{\infty} \exp\left(\frac{-\epsilon_{11}}{\sigma}\right) \exp\left(-\exp\left(-\frac{\epsilon_{11}}{\sigma}\right)\right) \exp\left(-\exp\left(-\frac{\epsilon_{11}+u_{11}-u_{21}}{\sigma}\right)\right) d\epsilon_{11} \\
=& \frac{1}{\sigma} \int_{-\infty}^{\infty} \exp\left(-\frac{\epsilon_{11}}{\sigma}\right) \exp\left[-e^{-\frac{\epsilon_{11}}{\sigma}} \left(1 + e^{-\frac{u_{11}-u_{21}}{\sigma}}\right)\right] d\epsilon_{11} \\
=& \frac{1}{1 + \exp\left(-\frac{u_{11}-u_{21}}{\sigma}\right)} \left[\exp\left[-e^{-\frac{\epsilon_{11}}{\sigma}} \left(1 + e^{-\frac{u_{11}-u_{21}}{\sigma}}\right)\right]\right]_{\epsilon_{11}=-\infty}^{\infty} \\
=& \frac{1}{1 + \exp\left(-\frac{u_{11}-u_{21}}{\sigma}\right)} = \frac{e^{u_{11}/\sigma}}{e^{u_{11}/\sigma} + e^{u_{21}/\sigma}}
\end{aligned}$$

Notice that such a result is also obtained by using a modified utility function:

$$V_{ij}^s \equiv \frac{1}{\sigma} U_{ij}^s = \frac{u_{ij}}{\sigma} + \frac{\epsilon_{ij}}{\sigma}, \tag{A2.6}$$

which gives:

$$V_{ij}^s = \frac{1}{\sigma} \ln \frac{w_{-i}^s}{P_i} + \frac{1}{\sigma} \ln\left(1 - c_{ij}^s\right) + \tilde{\epsilon}_i, \tag{A2.7}$$

where $\tilde{\epsilon}_i \sim EVD(0,1)$. The reciprocal of the EVD scale parameter is therefore equivalent to the parameter called $\alpha \equiv 1/\sigma$, by which we describe the sensitivity of individual's utility with respect to the real income, equivalent to the elasticity of the ratio of migrants with respect to the real wage ratio. Thus, the more dispersed distribution of the preferences towards migration (higher σ) the lower the sensitivity of the individuals' utility to real income and the smaller the reaction of migrants to the change in the ratio of real wages.

Appendix 3

Simulation algorithm

To simulate the model, we impose an exogenous change in the bilateral cost of either migration or trade. This shock causes the general equilibrium response in the system of N countries. In what follows, we describe in details the solution algorithm of the model after the migration or trade (or both) liberalization shock (see the right panel of Figure(A3.1)).

Initially, the parameters, exogenous variables and endogenous variables are calculated as in the calibration part. The liberalization shock is then applied by an exogenous change in the migration costs, trade costs or both of them. Now the new general equilibrium is iteratively restored, starting with recomputing the migration matrices (using the random utility expressions) and new labor supplies in each countries. Then, in order to obtain the equilibrium

wage levels, an inner loop is defined that iteratively solves the zero-profit conditions. The output of the latter is the vector of wage indexes. Then, the labor market clearing wages for all types of workers are specified. The wages themselves impact the migration matrices, which brings the outer loop back to the first step. The general condition for the outer iteration is the magnitude of change of the equilibrium wage indexes. The procedure stops when the difference between the old and the new wage indexes vector is small enough.

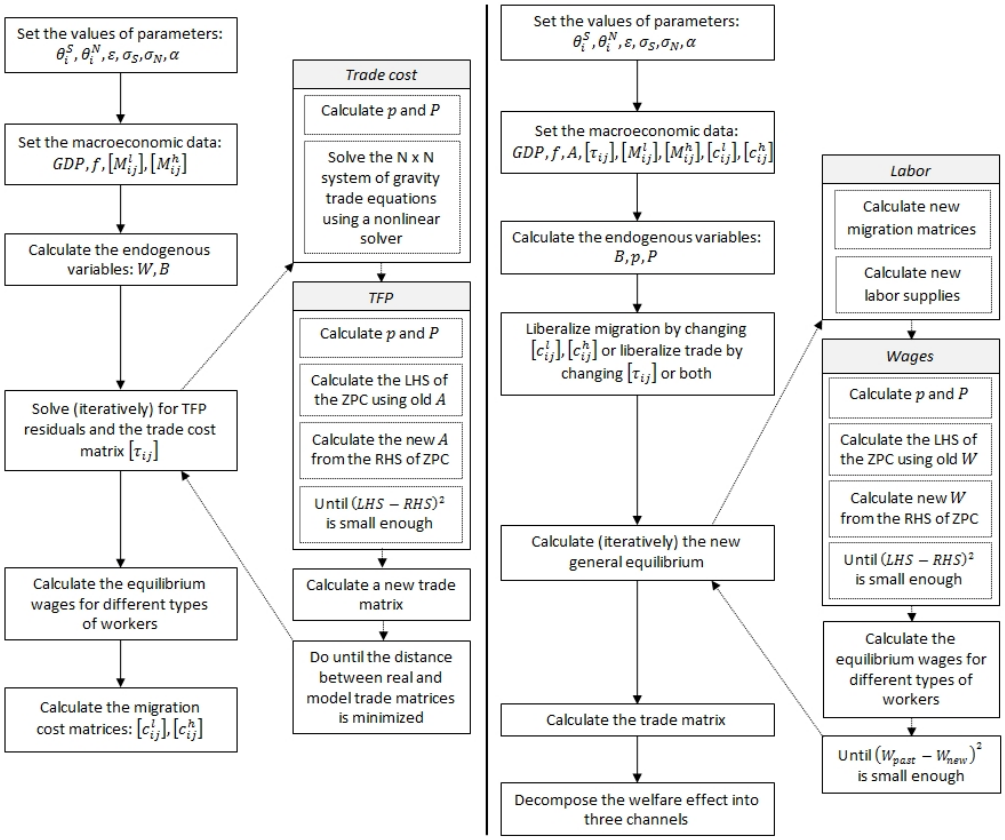

Figure A3.1: The calibration (left panel) and the simulation (right panel) algorithms.

Finally, the endogenous trade matrix is calculated according to the gravity expressions. The last step is to decompose the overall welfare effect of a particular shock into three channels: market size, wage and TFP effects. The first two are done without imposing the general equilibrium in the model. To isolate the market size effect we take the post-shock value of the number of varieties and calculate the welfare using the pre-shock values of all the other endogenous variables. In this way we control for the impact of B on the price indexes, through which the market size effect is transferred to the agents. In terms of the wage effects, the change in nominal wages influences the welfare both directly (through ΔW) and indirectly (through ΔP). The first effect is the nominal wage effect (so the change in welfare brought about only by changes in nominal wages), whereas the second one is the general equilibrium effect (the change in welfare due to the reaction of the price indexes as a consequence of different nominal wages). These two effects are generically opposite. Finally, the TFP effect is defined as a change in the real wages brought about by a change in the aggregated value of TFP, which influences only the real variables and has no impact on the nominal ones.

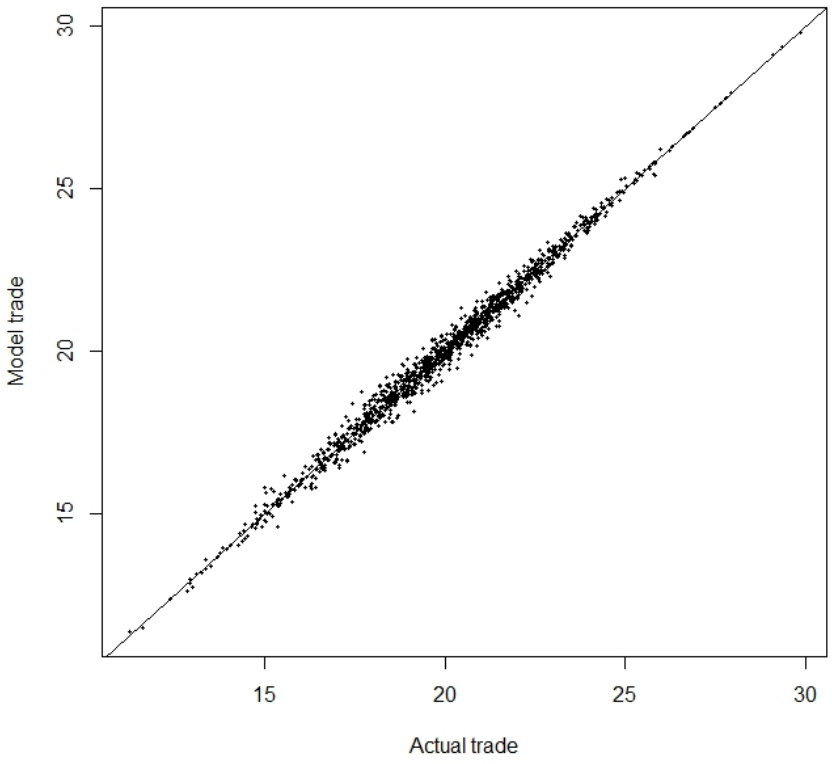

Figure A3.2: The matching of (log) of model trade with (log) of actual trade.

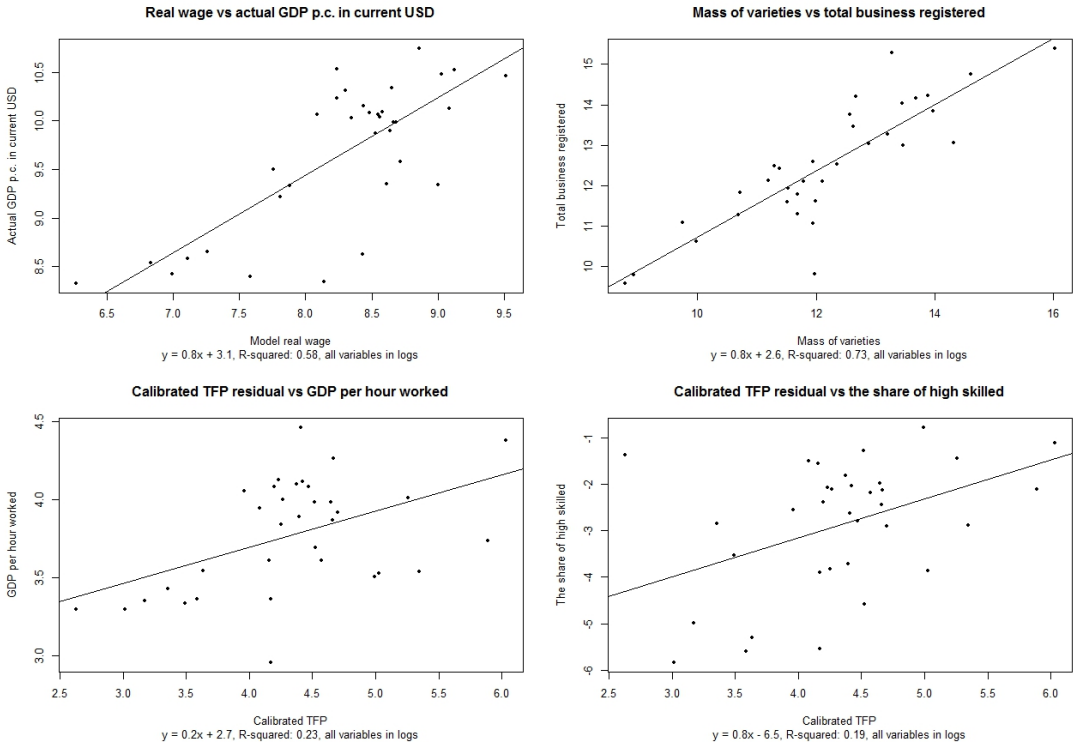

Figure A3.3: The matching of (log) of model variables with (log) of actual variables.

Appendix 4

Table A4.1: Estimation of formal bilateral migration cost for the low-skilled

	Dependent variable:				
	$\ln\left(M_{ij}^{l}/M_{jj}^{l}\right)$				
	(1)	(2)	(3)	(4)	(5)
$\ln\left(\frac{w_{-i}^{l}/P_i}{w_j^{l}/P_j}\right)$	0.507^{***}	0.757^{***}	1.012^{***}	0.716^{***}	0.942^{***}
	(0.065)	(0.076)	(0.069)	(0.067)	(0.065)
ShortVISA		-0.553^{**}	-0.261	-0.531^{*}	-0.500^{**}
		(0.248)	(0.254)	(0.314)	(0.224)
LongVISA		-0.976^{***}	-0.467^{**}	-0.355^{**}	-0.607^{***}
		(0.177)	(0.190)	(0.169)	(0.176)
Log distance			-0.728^{***}	-0.898^{***}	-0.252^{***}
			(0.068)	(0.065)	(0.072)
Log Pop ex				-0.023	-0.119^{***}
				(0.039)	(0.039)
Log Pop im				0.807^{***}	
				(0.042)	
Border					2.299^{***}
					(0.286)
Language					1.565^{***}
					(0.242)
Constant	-8.415^{***}	-7.517^{***}	-2.247^{***}	-13.623^{***}	-4.344^{***}
	(0.084)	(0.150)	(0.516)	(0.992)	(0.791)
exp FE	Yes	Yes	Yes	Yes	Yes
imp FE	Yes	Yes	Yes	Yes	Yes
Observations	1 190	1 190	1 190	1 190	1 190
Adjusted R^2	0.531	0.582	0.581	0.670	0.627

	(1)	(2)	(3)	(4)	(5)
Shapiro-Wilk test	0.999 (0.383)	0.999 (0.781)	0.998 (0.342)	0.995 (0.001)	0.998 (0.068)
RESET test	1.384 (0.251)	1.563 (0.210)	2.128 (0.120)	0.690 (0.501)	6.238 (0.002)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01, standard errors in parenthesis.

Table A4.2: Estimation of formal bilateral migration cost for the high-skilled

	Dependent variable:				
	$\ln\left(M_{ij}^h/M_{jj}^h\right)$				
	(1)	(2)	(3)	(4)	(5)
$\ln\left(\frac{w_{-i}^h/P_i}{w_j^h/P_j}\right)$	0.500^{***}	0.532^{***}	1.006^{***}	0.546^{***}	1.100^{***}
	(0.085)	(0.072)	(0.078)	(0.051)	(0.079)
ShortVISA		-0.696^{***}	-0.361^{*}	-0.478^{**}	-0.473^{**}
		(0.207)	(0.194)	(0.198)	(0.222)
LongVISA		-0.788^{***}	-0.495^{***}	-0.377^{**}	-0.708^{***}
		(0.170)	(0.162)	(0.157)	(0.167)
Log distance			-0.453^{***}	-0.511^{***}	-0.166^{**}
			(0.065)	(0.061)	(0.075)
Log Pop ex				0.085^{**}	-0.093^{**}
				(0.037)	(0.038)
Log Pop im				1.090^{***}	
				(0.037)	
Border					1.325^{***}
					(0.280)
Language					1.546^{***}
					(0.236)
Constant	-7.747^{***}	-7.283^{***}	-4.351^{***}	-22.674^{***}	-4.911^{***}
	(0.085)	(0.144)	(0.493)	(0.976)	(0.768)
exp FE	Yes	Yes	Yes	Yes	Yes
imp FE	Yes	Yes	Yes	Yes	Yes
Observations	1 190	1 190	1 190	1 190	1 190
Adjusted R^2	0.417	0.543	0.644	0.651	0.595

	(1)	(2)	(3)	(4)	(5)
Shapiro-Wilk test	0.998 (0.098)	0.998 (0.074)	0.998 (0.070)	0.993 (0.000)	0.998 (0.090)
RESET test	1.044 (0.352)	2.909 (0.055)	5.325 (0.005)	0.150 (0.861)	10.670 (0.000)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01, standard errors in parenthesis.

Table A4.3: Estimation of formal bilateral trade cost

	Dependent variable:				
	$\ln \tau_{ij}$				
	(1)	(2)	(3)	(4)	(5)
Tariffs and NTB	1.718^{***}	0.343^{**}	0.703^{***}	0.600^{***}	0.629^{***}
	(0.144)	(0.167)	(0.176)	(0.166)	(0.183)
Log distance		0.340^{***}	0.288^{***}	0.276^{***}	0.245^{***}
		(0.017)	(0.017)	(0.019)	(0.019)
Log Pop ex			-0.124^{***}	-0.095^{***}	-0.077^{***}
			(0.009)	(0.011)	(0.010)
PPP im / PPP ex			0.299^{***}	0.288^{***}	0.264^{***}
			(0.030)	(0.029)	(0.028)
Border				-0.159^{**}	-0.160^{**}
				(0.074)	(0.073)
Language				-0.273^{***}	-0.230^{***}
				(0.062)	(0.060)
Currency					-0.144^{**}
					(0.058)
Constant	1.546^{***}	-0.926^{***}	1.103^{***}	0.810^{***}	0.751^{***}
	(0.032)	(0.125)	(0.168)	(0.197)	(0.191)
exp FE	Yes	Yes	Yes	Yes	Yes
imp FE	Yes	Yes	Yes	Yes	Yes
Observations	1 190	1 190	1 190	1 190	1 190
Adjusted R^2	0.509	0.518	0.506	0.501	0.528

	(1)	(2)	(3)	(4)	(5)
Shapiro-Wilk test	0.998 (0.311)	0.999 (0.412)	0.998 (0.330)	0.999 (0.937)	0.999 (0.590)
RESET test	0.525 (0.592)	0.030 (0.971)	0.118 (0.889)	0.517 (0.600)	0.152 (0.859)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01, standard errors in parenthesis.

Appendix 5

Table A5.1: Aggregated gains from liberalizing migration

	EU							OECD						
	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp
MIN	-5,889	-3,749	-2,333	2,194	714	-30	-30	17,699	-8,608	-4,310	8,436	4,374	-13	-13
MID	-8,891	-5,309	-3,595	3,136	1,109	-44	-44	25,414	-12,250	-6,683	12,013	6,769	-19	-19
MAX	-11,366	-9,892	-4,245	5,929	1,290	-54	-53	41,423	-22,381	-8,014	22,014	8,219	-11	-11

The table provides the changes in the values of real GDP (in millions of PPP units), population of natives (low-skilled and high-skilled, in thousands of people), population of residents (low-skilled and high-skilled, in thousands of people), value of imports and exports (in billions of $) in the EU and OECD (considering 3 scenarios: MIN, MID and MAX), after liberalizing migration between all OECD countries.

Table A5.2: Aggregated gains from liberalizing trade

	EU							OECD						
	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp
MIN	1,658	-27	-20	49	9	90	95	9,997	187	31	23	101	499	499
MID	3,092	-53	-39	91	17	167	175	19,058	359	60	34	188	928	928
MAX	3,717	-65	-48	109	20	199	209	23,120	435	72	38	227	1,114	1,114

The table provides the changes in the values of real GDP (in millions of PPP units), population of natives (low-skilled and high-skilled, in thousands of people), population of residents (low-skilled and high-skilled, in thousands of people), value of imports and exports (in billions of $) in the EU and OECD (considering 3 scenarios: MIN, MID and MAX), after liberalizing trade between all OECD countries.

Table A5.3: Aggregated gains from liberalizing migration and trade

	EU							OECD						
	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp	Real GDP	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h	Imp	Exp
MIN	-4,347	-3,794	-2,363	2,230	720	60	65	27,328	-8,334	-4,266	8,370	4,460	488	488
MID	-6,115	-5,411	-3,662	3,195	1,116	121	130	43,461	-11,658	-6,587	11,811	6,916	917	917
MAX	-8,158	-10,063	-4,331	5,970	1,295	144	154	62,751	-21,488	-7,886	21,587	8,381	1,119	1,119

The table provides the changes in the values of real GDP (in millions of PPP units), population of natives (low-skilled and high-skilled, in thousands of people), population of residents (low-skilled and high-skilled, in thousands of people), value of imports and exports (in billions of $) in the EU and OECD (considering 3 scenarios: MIN, MID and MAX), after liberalizing migration and trade between all OECD countries.

Appendix 6

Table A6.1: The Welfare and Demographic Effects of Migration Liberalization (using Gallup data)

ISO	Change in real wage					Change in labor force			
Code	W_i/P_i	w_i^l/P_i	w_i^h/P_i	w_{-i}^l/P_i	w_{-i}^h/P_i	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h
CHE	13,22%	12,07%	14,42%	5,38%	8,05%	-2,61%	-3,74%	233,34%	202,83%
AUS	3,55%	-1,56%	9,58%	-4,94%	9,31%	-3,77%	-1,94%	93,37%	2,92%
NZL	2,23%	0,04%	5,61%	-3,54%	6,09%	-7,61%	4,01%	91,56%	-4,97%
GBR	1,99%	2,50%	1,46%	-0,71%	0,50%	-1,02%	3,83%	87,11%	25,51%
CAN	1,66%	-3,89%	6,29%	-7,51%	6,00%	-8,13%	-6,14%	98,30%	-0,85%
USA	1,15%	-2,54%	3,39%	-5,31%	3,67%	-0,38%	-1,15%	77,39%	-6,33%
ROW	1,03%	2,82%	-1,67%	2,76%	-6,17%	0,07%	8,16%	1,30%	175,74%
IRL	1,02%	1,97%	-0,03%	-0,80%	-1,86%	-7,94%	-8,39%	59,64%	32,57%
ISL	0,07%	-0,68%	1,30%	-3,89%	0,16%	-6,41%	-6,90%	80,39%	16,67%
CZE	-0,24%	-0,94%	1,02%	-4,60%	-1,99%	-4,74%	-6,81%	102,12%	70,79%
LUX	-0,44%	-3,34%	2,32%	-4,16%	2,12%	-3,72%	-8,45%	14,27%	-4,69%
AUT	-0,62%	-4,68%	3,55%	-7,10%	1,46%	-6,74%	-14,90%	55,77%	27,86%
NOR	-0,70%	-2,37%	1,44%	-5,73%	-1,04%	-6,12%	-11,70%	89,30%	44,81%
ESP	-0,96%	-2,36%	0,62%	-3,23%	0,95%	-1,26%	-4,84%	18,05%	-10,81%
JPN	-1,07%	-2,35%	0,26%	-8,10%	-2,27%	-4,03%	-6,85%	223,52%	55,16%
OECD	**-1,11%**	**-3,98%**	**2,28%**	**-6,64%**	**1,27%**	**-6,58%**	**-11,33%**	**71,49%**	**23,52%**
TUR	-1,46%	-1,43%	-1,51%	-3,42%	-3,03%	-5,92%	-6,81%	41,41%	27,23%
BEL	-1,50%	-6,36%	3,10%	-7,60%	2,67%	-4,71%	-16,81%	24,35%	-9,60%
DEU	-1,51%	-4,26%	1,68%	-6,61%	1,69%	-5,32%	-11,11%	55,56%	-11,40%
NLD	-1,58%	-4,93%	2,56%	-6,20%	3,97%	-5,92%	-10,00%	23,25%	-31,57%
FIN	-1,85%	-4,17%	0,35%	-8,12%	-3,11%	-6,13%	-12,47%	117,84%	76,39%
SWE	-1,90%	-5,73%	2,69%	-8,11%	2,43%	-7,94%	-15,68%	53,49%	-11,31%
MEX	-2,43%	-2,63%	-2,18%	-7,54%	-7,64%	-10,39%	-14,47%	152,19%	169,61%
FRA	-2,46%	-6,08%	1,35%	-6,89%	1,96%	-4,41%	-14,52%	13,74%	-24,27%
DNK	-2,67%	-5,36%	0,85%	-7,81%	-0,99%	-8,54%	-16,83%	54,31%	20,15%
SVN	-2,77%	-5,32%	0,11%	-6,34%	-0,10%	-7,97%	-14,63%	14,37%	-10,95%
ISR	-2,87%	-12,71%	8,66%	-14,06%	11,33%	-3,13%	-6,36%	32,05%	-42,34%
SVK	-2,97%	-4,72%	-0,06%	-9,52%	-2,43%	-9,29%	-16,52%	155,21%	34,67%
HUN	-3,14%	-6,22%	0,98%	-10,43%	-4,90%	-11,89%	-23,17%	120,68%	154,63%
POL	-3,26%	-5,35%	-0,30%	-8,07%	-1,90%	-9,63%	-16,76%	61,76%	15,11%
GRC	-3,38%	-6,33%	0,44%	-6,99%	1,94%	-6,54%	-15,20%	7,76%	-36,90%
PRT	-3,57%	-6,74%	-0,39%	-7,15%	-0,64%	-6,95%	-17,07%	1,45%	-12,75%
EST	-3,78%	-13,53%	10,63%	-13,29%	21,62%	-6,75%	-11,65%	-11,72%	-86,70%
KOR	-4,48%	-6,05%	-3,09%	-10,44%	-6,32%	-13,59%	-18,15%	125,06%	61,34%
ITA	-4,73%	-8,47%	0,15%	-9,48%	-0,36%	-10,57%	-23,29%	11,76%	-15,18%
CHL	-6,16%	-10,87%	0,32%	-13,34%	-4,35%	-13,50%	-29,88%	51,95%	81,96%

The table presents changes in: real wage indexes, real wages of four types of workers and stocks of low/high-skilled natives/foreigners, after liberalizing migration (MID scenario). OECD stands for the unweighted average change in the OECD countries, ROW stands for the Rest of the World.

Table A6.2: The Welfare and Demographic Effects of Migration Liberalization (MID scenario, $\alpha = 0.7$)

ISO	Change in real wage					Change in labor force			
Code	W_i/P_i	w_i^l/P_i	w_i^h/P_i	w_{-i}^l/P_i	w_{-i}^h/P_i	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h
NZL	3.23%	3.98%	2.07%	2.37%	0.27%	-0.72%	-4.84%	35.65%	35.73%
AUS	2.92%	2.79%	3.07%	1.28%	1.65%	-1.54%	-5.00%	32.53%	25.16%
CHE	2.20%	1.91%	2.51%	0.23%	0.35%	-2.04%	-6.00%	36.62%	43.73%
ISR	1.54%	1.34%	1.78%	0.67%	0.67%	-2.08%	-8.59%	11.73%	13.95%
CAN	1.42%	1.25%	1.57%	0.02%	0.40%	-1.97%	-3.76%	25.15%	21.45%
USA	0.89%	0.38%	1.19%	-0.78%	0.22%	-0.19%	-0.26%	26.05%	20.99%
IRL	0.33%	0.48%	0.18%	-1.78%	-2.59%	-9.56%	-20.07%	42.52%	40.00%
LUX	0.08%	-0.12%	0.28%	-0.28%	-0.10%	-0.76%	-2.36%	2.37%	5.41%
AUT	0.04%	-0.83%	0.94%	-1.62%	-0.01%	-1.43%	-3.60%	15.53%	16.43%
SWE	0.03%	-0.31%	0.44%	-0.72%	-0.18%	-0.36%	-2.00%	8.22%	10.95%
BEL	0.02%	-0.53%	0.54%	-1.06%	0.09%	-0.42%	-1.61%	10.86%	7.74%
JPN	0.00%	-0.16%	0.17%	-1.24%	-1.10%	-0.10%	-0.80%	24.21%	28.04%
ROW	0.00%	0.00%	0.01%	0.05%	0.27%	0.01%	-0.01%	-1.00%	-5.18%
OECD	**-0.01%**	**-0.54%**	**0.65%**	**-1.40%**	**-0.52%**	**-1.88%**	**-5.21%**	**17.47%**	**20.34%**
NLD	-0.02%	-1.13%	1.35%	-1.84%	0.76%	-1.24%	-4.97%	13.99%	6.67%
ESP	-0.06%	-0.21%	0.10%	-0.48%	-0.37%	-0.29%	-1.22%	5.27%	8.61%
CZE	-0.07%	-0.91%	1.46%	-2.51%	-0.31%	-1.17%	-5.50%	36.96%	34.17%
NOR	-0.08%	-0.47%	0.41%	-1.03%	-0.40%	-0.52%	-2.80%	11.40%	14.36%
FRA	-0.10%	-0.36%	0.17%	-0.58%	-0.36%	-0.38%	-1.50%	4.01%	9.34%
DEU	-0.12%	-0.75%	0.61%	-1.67%	-0.26%	-1.02%	-3.04%	19.08%	15.26%
FIN	-0.18%	-0.60%	0.22%	-1.46%	-0.78%	-0.47%	-1.91%	18.45%	19.94%
DNK	-0.29%	-0.95%	0.57%	-1.51%	-0.11%	-0.61%	-3.19%	11.19%	10.78%
EST	-0.30%	-0.90%	0.59%	-1.03%	0.11%	-2.69%	-8.03%	-0.21%	1.21%
ISL	-0.36%	-1.33%	1.23%	-2.14%	0.49%	-1.24%	-6.71%	16.40%	7.96%
ITA	-0.48%	-0.68%	-0.22%	-0.95%	-0.84%	-1.46%	-2.40%	3.97%	10.49%
HUN	-0.68%	-2.20%	1.35%	-3.51%	-0.59%	-1.63%	-7.72%	28.84%	35.66%
CHL	-0.71%	-1.70%	0.65%	-2.25%	-0.92%	-0.81%	-4.91%	11.00%	30.21%
GBR	-0.73%	-1.86%	0.47%	-2.71%	-1.14%	-2.59%	-10.25%	15.72%	23.85%
TUR	-0.75%	-0.73%	-0.79%	-1.85%	-2.70%	-3.41%	-5.47%	21.30%	39.30%
KOR	-0.79%	-1.72%	0.03%	-1.95%	-1.40%	-1.41%	-4.60%	3.31%	27.22%
SVN	-0.99%	-1.74%	-0.15%	-2.05%	-0.88%	-3.76%	-7.05%	2.53%	7.62%
PRT	-1.01%	-1.60%	-0.42%	-1.81%	-0.99%	-2.72%	-5.02%	1.65%	6.37%
GRC	-1.03%	-1.59%	-0.30%	-1.86%	-0.93%	-2.79%	-5.41%	2.73%	7.25%
POL	-1.20%	-2.80%	1.07%	-3.32%	0.14%	-1.87%	-8.73%	9.33%	9.68%
SVK	-1.39%	-2.17%	-0.09%	-3.56%	-2.09%	-4.68%	-8.60%	27.04%	36.86%
MEX	-1.59%	-2.13%	-0.92%	-4.66%	-3.66%	-6.04%	-9.30%	58.65%	59.01%

The table presents changes in: real wage indexes, real wages of four types of workers and stocks of low/high-skilled natives/foreigners, after liberalizing migration (MID scenario). OECD stands for the unweighted average change in the OECD countries, ROW stands for the Rest of the World.

Table A6.3: The Welfare and Demographic Effects of Migration Liberalization (MID sc., endog. TFP)

ISO	Change in real wage					Change in labor force			
Code	W_i/P_i	w_i^l/P_i	w_i^h/P_i	w_{-i}^l/P_i	w_{-i}^h/P_i	L_i^l	L_i^h	L_{-i}^l	L_{-i}^h
NZL	6.68%	7.82%	4.92%	5.19%	2.16%	-0.71%	-6.65%	62.92%	59.10%
AUS	4.63%	4.35%	4.95%	1.99%	2.73%	-2.53%	-8.13%	54.01%	40.91%
CHE	3.26%	2.83%	3.71%	0.32%	0.53%	-3.03%	-9.01%	58.96%	69.78%
ISR	2.75%	2.50%	3.05%	1.40%	1.27%	-3.07%	-12.72%	20.41%	23.63%
CAN	2.14%	1.81%	2.41%	-0.07%	0.62%	-2.96%	-5.76%	40.90%	34.15%
USA	0.97%	0.19%	1.44%	-1.52%	-0.01%	-0.29%	-0.41%	40.83%	32.79%
IRL	0.40%	0.59%	0.20%	-2.73%	-3.75%	-13.61%	-28.34%	69.10%	60.20%
ROW	-0.01%	-0.01%	-0.01%	0.01%	0.38%	0.02%	0.01%	-0.34%	-7.45%
LUX	-0.15%	-0.66%	0.34%	-0.99%	-0.25%	-1.13%	-3.66%	5.64%	8.40%
JPN	-0.22%	-0.48%	0.05%	-2.10%	-1.80%	-0.16%	-1.27%	38.67%	43.59%
ESP	-0.36%	-0.60%	-0.09%	-1.01%	-0.80%	-0.45%	-1.91%	8.24%	13.07%
SWE	-0.43%	-0.98%	0.24%	-1.61%	-0.70%	-0.55%	-3.16%	13.00%	16.82%
FRA	-0.52%	-0.94%	-0.08%	-1.27%	-0.86%	-0.58%	-2.39%	6.26%	14.19%
BEL	-0.67%	-1.56%	0.17%	-2.39%	-0.52%	-0.66%	-2.56%	17.64%	11.93%
NOR	-0.71%	-1.33%	0.09%	-2.17%	-1.12%	-0.81%	-4.43%	17.74%	22.01%
OECD	**-0.80%**	**-1.64%**	**0.23%**	**-2.88%**	**-1.48%**	**-2.93%**	**-8.06%**	**26.96%**	**31.24%**
FIN	-0.83%	-1.51%	-0.18%	-2.78%	-1.63%	-0.74%	-3.05%	28.61%	29.94%
DEU	-1.09%	-2.08%	0.04%	-3.38%	-1.23%	-1.62%	-4.83%	28.42%	22.92%
ITA	-1.12%	-1.45%	-0.69%	-1.84%	-1.60%	-2.31%	-3.82%	5.72%	15.72%
AUT	-1.16%	-2.50%	0.21%	-3.62%	-1.17%	-2.33%	-5.74%	23.10%	24.57%
TUR	-1.35%	-1.36%	-1.33%	-3.12%	-4.23%	-5.31%	-8.94%	35.86%	65.45%
EST	-1.35%	-2.27%	0.01%	-2.40%	-0.70%	-4.25%	-12.37%	-1.59%	1.12%
DNK	-1.48%	-2.51%	-0.13%	-3.29%	-1.12%	-0.98%	-5.07%	16.16%	15.94%
NLD	-1.57%	-3.29%	0.55%	-4.32%	-0.32%	-2.07%	-7.88%	21.16%	9.71%
CZE	-1.79%	-3.10%	0.57%	-5.33%	-1.93%	-1.87%	-8.59%	56.25%	51.36%
ISL	-2.16%	-3.45%	-0.05%	-3.95%	-1.10%	-2.02%	-10.59%	8.68%	10.52%
KOR	-2.34%	-3.81%	-1.04%	-4.12%	-3.08%	-2.27%	-7.30%	4.29%	40.85%
PRT	-2.50%	-3.40%	-1.60%	-3.65%	-2.41%	-4.48%	-8.00%	0.56%	8.52%
GRC	-2.63%	-3.50%	-1.50%	-3.85%	-2.41%	-4.61%	-8.66%	2.66%	9.90%
GBR	-2.63%	-4.36%	-0.80%	-5.49%	-3.12%	-4.28%	-15.91%	21.55%	35.02%
SVN	-2.70%	-3.85%	-1.42%	-4.23%	-2.47%	-5.96%	-11.04%	1.87%	10.38%
CHL	-2.88%	-4.51%	-0.64%	-5.26%	-2.91%	-1.39%	-8.15%	15.47%	45.84%
HUN	-3.43%	-5.78%	-0.29%	-7.48%	-3.01%	-2.70%	-12.13%	40.13%	52.83%
MEX	-3.51%	-4.32%	-2.47%	-7.89%	-6.38%	-9.50%	-14.48%	93.49%	94.04%
SVK	-3.70%	-4.94%	-1.63%	-7.19%	-4.43%	-7.23%	-13.29%	49.85%	54.41%
POL	-4.74%	-7.19%	-1.24%	-7.79%	-2.55%	-3.18%	-13.80%	10.09%	12.44%

The table presents changes in: real wage indexes, real wages of four types of workers and stocks of low/high-skilled natives/foreigners, after liberalizing migration (MID scenario). OECD stands for the unweighted average change in the OECD countries, ROW stands for the Rest of the World.