Abstract:

The main objective of the paper is to establish the link between the exogenous migration shocks and endogenous foreign direct investment flows in a small open economy setting with international capital mobility, immobile labour and a non-traded good. I find that the immigration of the high-skilled individuals and FDI flows are always complements in the quantity sense. The immigration of the low-skilled individuals will cause an outflow (inflow) of capital, if domestic non-traded and imported goods are relatively weak (strong) substitutes in consumption. Besides, I explain the attitudes of native individuals towards high-skilled and low-skilled immigrants.

Keywords: international factor mobility, non-traded good, general equilibrium, imperfect import substitution (Armington assumption), direct democracy, EU enlargement.

JEL: F21, F22, J61.
1. INTRODUCTION

Globalization has become a major feature of the modern economic world. The removal of barriers to trade and production factor flows, integration of markets and creation of economic blocks are believed to bring substantial gains to the countries opening their borders, as well as to enhance global welfare. The movement of goods, labour, capital, technology and services in search of better opportunities is constantly growing all over the world, leading to more efficient resource allocation and new patterns of income distribution.

Undoubtedly, increasing liberalization brings about higher interdependence of all channels of integration, creating non-negligible positive and negative externalities. For example, trade liberalisation is assumed to be a growth-driving factor for the less developed countries; however, the secondary effects may include costly resource reallocation, disappearing of entire industries, and possibly, emigration pressures. Free movement of people is not only associated with gains and losses for the host county, such as higher growth prospects, resolution of the problems related to social payments and ageing population, transfer of ideas, or illegal immigration, but also has both positive and negative repercussions on sending countries (e.g., remittances, brain-drain). Therefore, besides separate examination of determinants of trade, migration and FDI flows, it is also necessary to find out how different integrated markets interact. The causality links between international factor and good flows are equally important, since they allow studying the reaction of other markets (e.g., goods and capital) to a change in one particular market (e.g., labour).

Despite the increased volumes of goods and factor crossing borders, one must recognise that asymmetries exist in the speed, incentives and policies applied to these movements. Specifically, the barriers to the movement of labour have always been higher than those applied to capital flows and good flows. The obvious reason is that, beyond purely economic considerations, flows of labour are associated with additional economic and human costs both concerning migrants’ incentives to move (family, distance, foreign language etc), and the attitudes towards foreign labour and policies applied in the host country (nationalism, patriotism etc). If labour migration entails a monetary cost, some financially constrained would-be migrants are unable to move to the desired destination (especially, in relatively poor countries). Trade liberalisation raises income and relaxes the financial constraint, thereby increasing outward migration. See Lopez and Schiff (1998).

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xenophobia, but also cultural enrichment). Therefore, different degrees of liberalisation and the easiness with which factors can move from one country to another imply that some of them would move endogenously in response to the exogenous shocks of the others.

A substantial amount of economic literature describes the link between trade and factor flows. The majority of the existing international trade models view all factors of production as apersonal units and concentrate primarily on question of substitution or complementarity between trade on one side and migration and capital flows on the other. The world in such models often consists of two countries, and trade liberalization equalizes good, and under certain assumptions, factor prices across countries. Less attention has been devoted to the link between labour and capital flows (without trade), as well as to the case of a small price-taking economy, and the role of non-traded goods in it. This paper aims at explaining the relationship which may exist between migration and trade flows under the assumption of free trade and internationally mobile capital, and regulated, non-perfect international labour flows.

The example of the contemporary European Union is only one that offers interesting evidence about factor flows. The eastern enlargement and simultaneous economic integration process initiated in mid-90s were marked by rapid trade liberalization between old and new member states. The obstacles for FDI flows have also been removed by mutual agreement of both sides, making another step towards integrated single market. On the contrary, the progress toward free movement of labour has been extremely slow, and was determined in potential host countries more by political and social, than economic considerations. Currently, only three of the old member states are open for migrants from the new states, the others introduced at least 2 year transition period. Migration issues continue to be central in the talks on Turkey’s adhesion to the European Union. Thus, the asymmetry between capital and labour flows within the Union is obvious: capital flows freely in response to better employment opportunities, whereas European labour movements are highly determined by national regulation. Therefore, I study the endogenous response of FDI to an exogenous immigration “shock”, for example, in the case where one particular country decides to increase its immigration quota. I derive the conditions under which migration and capital

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3 For the role of non-economic arguments in international labour migration, see, for example, Hillman and Weiss (1999) and Schiff (2002).
4 The United Kingdom, Ireland and Sweden.
flows are complements and substitutes in the quantity sense, and analyse how is the welfare of different population groups affected after the change in immigrants supply.

The model that I develop comprises several labour market and demand characteristics. I differentiate between low-skilled and high-skilled native workers and immigrants, and assume that the low-skilled (high-skilled) are specific to the production of domestic non-traded (exported) good. The rational for these assumptions is a common evidence (especially, in Europe) that labour is becoming increasingly immobile between industries, and that low-skilled natives and immigrants are mostly employed in the production of non-traded goods and services, e.g., in hotel business, construction, and to some extent in agriculture. The supply of immigrants is inelastic, meaning that in the rest of the world there is always a sufficient amount of workers willing to move to the host country. Capital is internationally mobile and its price is given by the world market. Any movement away from equilibrium in home country is immediately compensated by inward or outward capital flows which restore equilibrium. I introduce a non-traded good on demand side, and allow for different degrees of substitution between non-traded and imported goods. I find that inflow of high-skilled immigrants always leads to inward investment flows, suggesting complementary relationship between the two. On the other hand, low-skilled immigration and FDI are substitutes (complements) in the quantity sense, if domestic non-traded good is weak (strong) substitute for imported good. Finally, relying on the analysis of individual welfare change I describe what attitudes towards immigration would a median voter adopt.

The paper is organised as follows. Section 2 provides a brief overview of relevant literature. In section 3 I present model’s set-up, as well as investigate the link between migration and FDI, if all produced goods are tradable. The general equilibrium analysis of the endogenous capital response to migration shocks is developed in section 4. I examine native individuals’ welfare change due to immigration and consecutive FDI flows, and explain their attitudes towards immigrants and immigration policy formation in direct democracy in section 5. Conclusions follow in section 6.

2. RELATED CONTRIBUTIONS
As mentioned above, the largest part of the existing international trade literature focuses on substitutability relationship of trade vis-à-vis factor flows, and does not say much about the links between different factor flows.

Wong (2004) distinguishes between two senses of substitution in factor movements – the price sense and the quantity sense. The factors are said to be substitutes (complements) in the price sense, if each of them is sufficient (both are necessary) to give efficient allocation of resources in the world and to ensure the equalization of factor prices in host and source countries. In the quantity sense, labour and capital are substitutes (complements), if the inflow on any of them induces the outflow (inflow) of the other.

The simplest case to assess substitutability between labour and capital movements is a two country world where only one good is produced with labour and capital (Wong, 2004). It is assumed that two countries differ in their relative factor endowments, and under autarky they have different factor price ratios. Factor market liberalisation leads to the movement of a factor from a country where it is relatively abundant to a country where it is relatively scarce. As a result, factor prices are equalised across countries. Capital and labour flows in this case are substitutes both in price and quantity sense.

Mundell (1957) explores the link between trade and factor movements in 2x2x2 Heckscher-Ohlin model, and finds that they are substitutes in the price and quantity sense. Under free trade and production diversification, factor prices are equalized across countries, leading zero incentives to factor movements. Thus, neither capital, nor labour movements are necessary to increase the efficiency of resource allocation. However, if under free trade a country experiences an exogenous inflow of one production factor, then factor prices stay constant there is no additional motivation for the other factor to move. Therefore, labour and capital in such a framework are neither complements, nor substitutes.

Baldwin and Venables (1994) study the interaction between different types of factor mobility in the European Eastern enlargement context. They assume that human capital and physical capital are complements, therefore the rate at which foreign capital flows into new member states affects high-skilled labourers’ wage. Since current and expected wage differentials

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5 The limitation of such a framework is the absence of trade in goods.
influence the decision of the high-skilled to emigrate, the inflow of capital will affect the long-run level of human capital. The changes in the stock of high-skilled workers in turn affect the return on foreign investment, meaning that there is circular relationship between high-skilled labour and capital flows, and that long-run factor endowments in the new member states are not predetermined. Baldwin and Venables introduce an externality linking the cost of absorbing foreign capital to the stock of skilled labour in the country, and establish that two expectations transition paths are possible: “vicious”, associated with high levels of skilled labour emigration and low levels of foreign capital inflow, and “virtuous” involving little emigration, substantial inflows of foreign capital and technology, and rising wages in the Eastern European states.

Davis and Weinstein (2002) use the example of the United States and argue that high-skilled labour, low-skilled labour and capital simultaneously seek to enter the US economy because of the technological superiority with respect to the rest of the world. Factor flows in such a case are complementary in the quantity sense.

One of the differences of the present paper vis-à-vis the above mentioned contributions is the assumption of asymmetry in labour and capital flows. I assume that capital can move freely across borders implying capital price equalization in the world, whereas movements of labour are subject to national immigration regulation. Therefore, the principal aim of the paper is to find the reaction of the internationally mobile capital to exogenous positive or negative immigration shocks (changes in immigration policy). In other words, I find out under which conditions the capital and low- and high-skilled labour flows are substitutes and complements in the quantity sense. A non-traded good, as well as the degree of substitution between imported and non-traded goods, are of particular importance in the model. Finally, I obtain the change in individual welfare and explain native voters’ attitudes towards immigration. The latter are transmitted into immigration policy under direct democracy.

3. THE MODEL
In this section I lay out the model and establish the link between the exogenous migration and endogenous capital flows, using a general equilibrium framework\(^6\). Sub-section 3.1. develops supply side of the model, and provides an answer in which direction the FDI would go after the inflow of either low-skilled, or high-skilled foreign workers, if the prices of both goods are fixed at the international market. Then in sub-section 3.2. I introduce a domestic non-traded good, which is an imperfect substitute for the imported good. In the last sub-section I show the initial equilibrium.

3.1. SUPPLY SIDE

In this sub-section, I describe briefly the production structure of the economy, and establish the formal link between factor prices and factor supplies, following the analysis of 3x2 specific-factor model in Jones (1971). Before introducing the consumption side with the non-traded good, I show how capital would respond to migration chocks if both consumption goods were tradable.

Let’s consider a classic Ricardo-Viner two-sector economy producing two goods with three factors of production. I denote the two goods and the corresponding industries by D and E\(^7\). Each industry uses one kind of labour, \(V_D\) and \(V_E\), and some amount of capital, \(V_{ND}\) and \(V_{NE}\). I let the low-skilled (high-skilled) labour be specific to D (E) industry. The production function in each sector exhibits constant returns to scale, and the marginal product of capital is diminishing. \(a_{DD} (a_{EE})\) is the amount specific factor \(V_D (V_E)\) necessary to produce one unit of good D (E). The amount of the mobile factor necessary to produce one unit of the domestic (export) good is equal to \(a_{ND} (a_{NE})\).

Under the assumption of full employment of factors the following conditions hold:

\[
\begin{align*}
    a_{DD} D &= V_D \\
    a_{EE} E &= V_E \\
    a_{ND} D + a_{NE} E &= V_N
\end{align*}
\]

\(^6\) This extended version of the model can be found in Ivels (2005). However, there capital is not mobile internationally.

\(^7\) D (E) willl correspond to the domestic non-traded (exported) good in a general equilibrium analysis.
Following Jones (1971, 1975), equations linking the changes in goods and factor prices are\(^8\):

\[
\theta_{DD}\hat{R}_D + \theta_{ND}\hat{R}_N = \hat{p}_D \tag{4}
\]

\[
\theta_{EE}\hat{R}_E + \theta_{NE}\hat{R}_N = \hat{p}_E, \tag{5}
\]

where \(R_N, R_D, R_E\) stand for the rewards to the mobile and specific factors, respectively; \(p_D\) and \(p_E\) are goods’ prices; \(\theta_j, i = D, E, N, j = D, E\), is factor’s \(i\) share in total income generated in sector \(j\), and ‘\(^\wedge\)’ over a variable denotes the relative change in that variable.

Let \(\sigma_D\) be the elasticity of substitution between factors in industry \(D\), relating the change in the \(\frac{a_{ND}}{a_{DD}}\) to the change in the factor price ratio (a comparable definition is applied to the sector \(E\)):

\[
\sigma_D = \frac{(\hat{a}_{ND} - \hat{a}_{DD})}{(\hat{R}_D - \hat{R}_N)} \quad \left( \sigma_E = \frac{(\hat{a}_{NE} - \hat{a}_{EE})}{(\hat{R}_E - \hat{R}_N)} \right) \tag{6}
\]

Using equations (1)-(6) one obtains formal solutions for the effects on factor returns of changes in commodity prices and factor endowments (change equations):

\[
\hat{R}_D = \left[ \beta_D + \frac{1}{\theta_{DD}} \beta_E \right] \hat{p}_D - \frac{\theta_{ND}}{\theta_{DD}} \beta_E \hat{p}_E + \frac{1}{\Delta \theta_{DD}} \left( \hat{\nu}_N - \lambda_{ND} \hat{\nu}_D - \lambda_{NE} \hat{\nu}_E \right) \tag{7}
\]

\[
\hat{R}_E = \left[ \beta_E + \frac{1}{\theta_{EE}} \beta_D \right] \hat{p}_E - \frac{\theta_{NE}}{\theta_{EE}} \beta_D \hat{p}_D + \frac{1}{\Delta \theta_{EE}} \left( \hat{\nu}_N - \lambda_{ND} \hat{\nu}_D - \lambda_{NE} \hat{\nu}_E \right) \tag{8}
\]

\[
\hat{R}_N = \beta_D \hat{p}_D + \beta_E \hat{p}_E + \frac{1}{\Delta} \left( \lambda_{ND} \hat{\nu}_D + \lambda_{NE} \hat{\nu}_E - \hat{\nu}_N \right) \tag{9}
\]

\(^8\) See Ivlevs (2005) for the derivation of all equations.
where \( \lambda_{N_j} \) is the fraction of the mobile factor absorbed by the j-th industry, \( j = D, E \);

\[
\Delta = \sum_{i=\Delta} \lambda_i \frac{\sigma_i}{\theta_i}; \quad \beta_{i,D,E} = \frac{\lambda_{N_i} \frac{\sigma_i}{\theta_i}}{\sum_{i=\Delta} \lambda_{N_i} \frac{\sigma_i}{\theta_i}}; \quad \sum_{i=\Delta} \beta_i = 1.
\]

The assumption of perfect international capital mobility implies that any downward (upward) pressure on the price of capital would cause a negative (positive) flow of capital. In the economy where capital is mobile both internationally and between industries, exogenous increases in both types of labour raise the price of capital due to higher marginal product of the latter. Assuming that both goods are tradable \( \hat{\rho}_D = \hat{\rho}_E = 0 \), substitution of \( \hat{\rho}_N \) for 0 in equation (9) yields positive values for the change in the amount of capital due to foreign labour inflow \( \frac{\hat{V}_N}{\hat{V}_j} = \lambda_{N_j}, \quad j = D, E \). In this case, capital “follows” labour.

Figure 1. The inflow of low-skilled labour and a consequent rise in FDI, when goods prices stay constant.

Graphically, an increase in supply of either type of labour (for example, the inflow of low-skilled foreigners is shown in figure 1) shifts the marginal product of capital schedule in the respective sector upwards (from MP’ to MP’’). The domestic return to capital raises instantaneously (point 2), which attracts foreign capital to the country. The total amount of
capital in the economy increases, pushing down the price of capital until its world equilibrium level \( R' \) is reached (point 3). On the graph, this corresponds to the leftward shift of the left vertical axis. The distance \( EE' \) is equivalent to \( V_N' \) and represents the inflow of foreign capital.

Note that with constant consumption prices the rewards to specific factors, domestic low-skilled and high-skilled labour, are not affected by immigration (equations (4) and (5)). Thus, the natives, independently of their factor ownership, would be indifferent to both types of immigrants if capital is mobile internationally and the goods produced in the economy are tradable.

The equation that expresses production volumes changes as a function of goods prices and factor supplies is given by:

\[
(\hat{D} - \hat{E}) = \Omega(\hat{p}_D - \hat{p}_E)(\hat{v}_D - \hat{v}_E) + \frac{1}{\Delta} \left( \frac{\theta_{ND}\sigma_D}{\theta_{DD}} - \frac{\theta_{NE}\sigma_E}{\theta_{EE}} \right) \left( \hat{v}_N - \lambda_{ND}\hat{v}_D - \lambda_{NE}\hat{v}_E \right)
\]

where \( \Omega = \theta_{ND} \frac{\sigma_D}{\theta_{DD}} \beta_E + \theta_{NE} \frac{\sigma_E}{\theta_{EE}} \beta_D \).

### 3.2. DEMAND SIDE.

The demand side of the model is based on the Armington assumption, under which imperfect substitution exists between two consumption goods: a domestic non-traded good (D) and an imported good (M). The domestic non-traded good is wholly produced and consumed domestically at a given time period, implying that the non-traded good market is always in equilibrium. The non-traded good is imperfect substitute for the imported good, and the degree (elasticity) of substitution given exogenously by parameter \( \sigma \). If \( \sigma \) tends to infinity, both consumption goods are perfect substitutes and the (change in) price of the non-traded good does not differ from the (change in) imported good price. At the other extreme, if the elasticity of substitution for imports tends to zero, and the change in imported good price will not be entirely translated into non-traded good price. Formally, the aggregate consumption function (Q) takes a CES form over two goods:
\[ Q(M, D, \sigma) = \left[ \chi M^{(\sigma - 1)/\sigma} + (1 - \chi) D^{(\sigma - 1)/\sigma} \right]^{\sigma/(\sigma - 1)} \]  \hspace{1cm} (11)

where \( \chi \) is a parameter that weights the import good relative to the home good.

Maximisation of (11) subject to the consumers’ budget constraint yields:

\[ \frac{M}{D} = k \left( \frac{p_D}{p_M} \right)^\sigma \]  \hspace{1cm} (12)

where \( k = \left( \frac{\chi}{1 - \chi} \right)^\sigma \) is a constant and \( p_D \) and \( p_M \) are prices paid by domestic consumers for domestic and import good.

3.3. INITIAL EQUILIBRIUM

To close the model, a relationship between the goods supplied and demanded in the economy is necessary. As mentioned above, the non-traded good market is always in equilibrium. Concerning traded goods, the assumption is made that all export revenues are used to purchase imports, thus keeping trade balance at zero value. With world prices of exports and imports given by \( \pi_e \) and \( \pi_m \), the following equality holds:

\[ \pi_M M = \pi_e E \]  \hspace{1cm} (13)

Choosing the nominal exchange rate as numeraire and assuming the absence of import tariffs and export subsidies, the domestic price for imports and the price at which exports are sold are equal to the respective world prices.

Figure 2 depicts economy’s initial equilibrium situation. The curve PP in the 4th quadrant represents production possibility frontier. Setting world prices equal to unity (a straight 45°
line in the 1st quadrant) and given that domestic good market is in equilibrium (3rd quadrant), the consumption possibility frontier (CC curve in the 2nd quadrant) is a mirror image of the PPF. Isoquants UU of the aggregate consumption function (equation 11) are demand indifference curves on the economy wide level, and define optimal mix of consumption goods. At the equilibrium point, curves UU and CC are tangent, and define the equilibrium consumption price ratio $\frac{p_D}{p_M}$. With the assumption about foreign prices and equality of non-traded good supply and demand, the consumption price ratio will be equal to the production price ratio $\left(\frac{p_D}{p_M} = \frac{p_D}{p_E}\right)$.

Fig. 2. Initial equilibrium.

4. IMMIGRATION, FACTOR PRICES AND CAPITAL FLOWS

Contrary to standard Ricardo-Viner model, where both goods are tradable, in this model the inflow of foreign labour will have an effect on the price of non-traded good. Moreover, the endogenous response of capital flows to immigration also alters the non-traded good price. Since the change in $p_D$ and factor supply changes have a direct influence on the price of
capital, the expression linking the change in capital price, factor supply changes and the change in non-traded good price is necessary.

Differentiation of equations (12) and (13) and use of (10) yields a following system (at constant import and export prices):

\[
\begin{aligned}
&\left( \dot{D} - \dot{E} \right) = \Omega \dot{p}_D + \left( \dot{V}_D - \dot{V}_E \right) + \frac{1}{\Delta} \left( \frac{\theta_{ND} \sigma_D}{\theta_{DD}} - \frac{\theta_{NE} \sigma_E}{\theta_{EE}} \right) \left( -\lambda_{ND} \dot{V}_D - \lambda_{NE} \dot{V}_E + \dot{V}_N \right) \\
&\dot{M} - \dot{D} = \sigma \dot{p}_D \\
&\dot{M} - \dot{E} = 0
\end{aligned}
\]

(14)

Solution of (14) provides an expression for the change in the non-traded good price as a function of changes in production factor supplies:

\[
\dot{p}_D = -\frac{1}{(\sigma + \Omega)} \left( \alpha_D \dot{V}_D + \alpha_E \dot{V}_E + \alpha_N \dot{V}_N \right),
\]

(15)

where

\[
\begin{aligned}
\alpha_D &= 1 - \lambda_{ND} \frac{1}{\Delta} \left( \frac{\theta_{ND} \sigma_D}{\theta_{DD}} - \frac{\theta_{NE} \sigma_E}{\theta_{EE}} \right), \\
\alpha_E &= -1 - \lambda_{NE} \frac{1}{\Delta} \left( \frac{\theta_{ND} \sigma_D}{\theta_{DD}} - \frac{\theta_{NE} \sigma_E}{\theta_{EE}} \right), \\
\alpha_N &= \frac{1}{\Delta} \left( \frac{\theta_{ND} \sigma_D}{\theta_{DD}} - \frac{\theta_{NE} \sigma_E}{\theta_{EE}} \right).
\end{aligned}
\]

It can be proved that coefficient \( \alpha_D \) is positive, \( \alpha_E \) is negative, and the sign of \( \alpha_N \) depends on the distributive shares with which the mobile factor is used in both industries, \( \theta_{Ni}, i = D, E \), as well as the elasticities of substitution of production in both sectors \( \sigma_i, i = D, E \). Thus, the inflow of the low-skilled foreign labour diminishes the price of the non-traded good, high-skilled immigrants raises it, while the impact of capital inflow on the non-traded good price depends on the production process characteristics, namely, in which sector the largest part of the inflowing FDI will be employed. The higher is degree of substitution between import and non-traded goods, the less impact on non-traded good price will be made
by changes in factor supplies. In what follows, the consequences of high-skilled and low-skilled immigration will be discussed separately.

4.1. HIGH-SKILLED IMMIGRATION

There are two channels through which the inflow of high-skilled foreign individuals affects the return to capital. First, higher amount of export industry specific factor raises marginal product of capital, and consequently, its price. Second, the expansion of export industry vis-à-vis non-traded sector makes non-traded good relatively scarcer and more expensive. This will move the marginal product of capital schedule upwards, leading to an additional rise in capital price. Inserting equation (15) into (9) yields the formal expression for the change in capital price due to high-skilled immigration:

\[
\hat{R}_N = \beta_D \hat{p}_D + \frac{\hat{\lambda}_{NE} \hat{V}_E}{\Delta} = -\beta_D \frac{\alpha_E \hat{V}_E}{(\sigma + \Omega)} + \frac{\hat{\lambda}_{NE} \hat{V}_E}{\Delta} > 0
\]  

(16.1)

Assuming that domestic return to capital was equal to its world equilibrium level prior to immigration, higher capital price after the inflow of high-skilled immigrants must immediately attract foreign capital in order to restore equilibrium. However, the inflowing capital does not only decrease its price, but also alters the price of the non-traded good, according to equation (15). The direction of change of non-traded good price can be both positive and negative, depending on production parameters \( \theta_{Ni} \) and \( \sigma_i, \ i = E, D \), thereby also determining the scope of final FDI flow.

To obtain the formal expression for the endogenous capital response due to high-skilled immigration, I use equation (9) to which I substitute equation (15) for non-traded good price. The capital price increase to be offset by capital and non-traded price movements is given by (16.1), which with negative sign enters the RHS of equation (9):

\[
(-1) \left( -\beta_D \frac{\alpha_E \hat{V}_E}{(\sigma + \Omega)} + \frac{\hat{\lambda}_{NE} \hat{V}_E}{\Delta} \right) = -\beta_D \frac{\alpha_N \hat{V}_N}{(\sigma + \Omega)} - \frac{\hat{V}_N}{\Delta}
\]
\[
\dot{V}_E \left( \beta_D \frac{\alpha_E}{\sigma + \Omega} - \frac{\lambda_{NE}}{\Delta} \right) = -\dot{V}_N \left( \beta_D \frac{\alpha_N}{\sigma + \Omega} + \frac{1}{\Delta} \right)
\]

\[
\frac{\dot{V}_N}{\dot{V}_E} = \left( \frac{-\beta_D \frac{\alpha_E}{\sigma + \Omega} + \frac{\lambda_{NE}}{\Delta}}{\beta_D \frac{\alpha_N}{\sigma + \Omega} + \frac{1}{\Delta}} \right)
\]

The nominator in the RHS of the last equation is positive, given that \( \alpha_E \) is negative. The proof that also the denominator \( \beta_D \frac{\alpha_N}{\sigma + \Omega} + \frac{1}{\Delta} \) is positive is available in appendix. This means that the effect from capital inflow on the reduction of capital price always surpasses the possible opposite effect from non-traded price change (if \( \alpha_N \) is negative), and FDI will unambiguously grow after the inflow of high-skilled immigrants. Concerning the quantity of the inflowing FDI, the degree is substitution between consumption goods, as well as the sign of \( \alpha_N \) are crucial. If the non-traded and imported goods are strong (perfect) substitutes \( (\sigma \to \infty) \), the effect of non-traded good price vanishes (whatever the sign of \( \alpha_N \) ), and FDI increases by \( \lambda_{NE} \) per cent due to 1 per cent increase in high-skilled immigration. If \( \sigma \) takes some finite value, positive (negative) value of \( \alpha_N \) implies lower (higher) inflowing FDI volumes; alternatively, if the main beneficiary of capital inflow due to high-skilled immigration is export sector (negative \( \alpha_N \) ) there will be more FDI than if the domestic non-traded sector were to assimilate the major part of the inflowing foreign capital.

I show the effect of high-skilled immigration of FDI flows on figures 2.1. and 2.2. The inflowing high-skilled individuals are immediately assimilated in the export industry, which moves the marginal product of capital curve in export sector upwards (from MP(E) to MP’(E)). The relative scarcity of the non-traded good results in its higher price and an upward movement of MP(D) schedule in domestic non-traded good sector (from MP(D) to MP’(D)). Both effects contribute to the rise in the price of capital from \( R \) to \( R' \). This corresponds to the movement of equilibrium from point 1 to point 2 in both graphs.
Fig. 2.1. High-skilled immigration induced change in FDI flow (capital inflow decreases the price of domestic non-traded good).

If $\alpha_N$ is positive, the capital inflow will lead to the fall in non-traded good price (figure 2.1.). The marginal product of capital in D sector schedule shifts downwards, and at the same time
the distance between two vertical axes increases. A new equilibrium is achieved at point 3 where capital price gets back to its world equilibrium level $R'$. The resulting FDI inflow corresponds to the distance $V'_N$.

A negative $\alpha_N$ implying the rise in non-traded good price (figure 2.2.), moves both marginal product of capital schedules to the right. Thus, a higher amount of foreign capital is necessary to decrease the capital price to its world level ($V''_N$), compared to ($V'_N$) in the case of negative $\alpha_N$.

To conclude, high-skilled immigration always results in inward foreign capital flows; moreover, the FDI inflow will be more (less) important, if the consecutive production possibility frontier shift is biased towards export (non-traded) good.

### 4.2. LOW-SKILLED IMMIGRATION.

The channels by low-skilled immigrants induce FDI flows are similar to those outlined in the high-skilled immigration case. Low-skilled immigrants are specific to the domestic non-traded sector, and the first effect of their inflow is the upward shift in the schedule of marginal product of capital in D sector (from MP(D) to MP(E) on figures 3.1. and 3.2.), raising the price of capital. At the same time, higher potential for the production of non-traded good decreases its price and moves the marginal product of capital schedule backwards, thus pushing capital price down. The aggregate effect on capital price depends on the value of elasticity of substitution between domestic non-traded and imported good $\sigma$: the capital price will increase (decrease), if $\sigma$ is higher (lower) than the elasticity of factor substitution in domestic industry $\sigma_D$. Figure 3.1 (3.2.) corresponds to the case where low-skilled immigration leads to lower (higher) capital price, with equilibrium moving from point 1 to 2. As a consequence, sufficiently low (high) level of $\sigma$ implies outflow of domestic capital (inflow of foreign capital).

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9 The formal proof can be found in Ivlevs (2005).
Fig. 3.1. Low-skilled immigration induced change in FDI flow ($\sigma < \sigma_D$), capital inflow decreases the price of domestic non-traded good.

Fig. 3.1. Low-skilled immigration induced change in FDI flow ($\sigma > \sigma_D$), capital inflow increases the price of domestic non-traded good.

As in the case of high-skilled immigrants, capital flows induce changes in non-traded good price, depending of the values of $\alpha_N$ (showing which sector absorbs more capital) and elasticity of substitution between consumption goods $\sigma$. This can increase or decrease capital
price, again modifying the extent of FDI inflows or outflows. In figure 3.1. I show the case where capital outflow diminishes non-traded good price (otherwise the curve MP''''(D) would end up somewhere between MP(D) and MP''(D)). In figure 3.2. capital inflow increases the domestic non-traded good price.

To obtain the formal expression for the change in capital flows after low-skilled immigration, one proceeds as in the case of high-skilled labour inflow (see equations 16.1. and 16.2.):

$$\frac{\hat{V}_{N}}{\hat{V}_{D}} = \frac{-\beta_{D} \lambda_{ND} (\sigma - \sigma_{D})}{\lambda_{ND} \left(\frac{\alpha_{ND}}{(\sigma + \Omega)} + \frac{1}{\Delta}\right)} = \frac{\theta_{ND} \sigma_{D}}{\theta_{DD} + \sigma}$$

(17)

Equation (17) confirms the critical role of the elasticity of substitution between consumption goods in determining the direction of FDI flows after low-skilled immigration. If non-traded and imported goods are strong substitutes ($\sigma \rightarrow \infty$), one percent increase in low-skilled immigration will lead to $\lambda_{ND}$ capital inflow. If elasticity of substitution between consumption goods is inferior to elasticity of factor substitution in production, the capital will flow out of the country.

5. ATTITUDES TOWARDS IMMIGRATION

Normally, if immigration of either high-skilled or low-skilled labour leads to positive FDI flows, creating economy’s higher productive capacity and growth prospects, native individuals should advocate such immigration. However, individuals are usually more preoccupied by immediate changes in their personal income instead of thinking about future average per capita income growth. In other words, “selfish” considerations about personal welfare will (almost) always dominate “altruistic” ones about economy’s as a whole growth prospects. Thus, when asked to express their views about inflow of foreign labour and, consequently, on the shape of immigration policy, I assume that the typical voter’s choice would be the reflection of the change in her welfare after immigration.
Leaving social, xenophobic or cultural arguments aside\textsuperscript{10}, I will assume that individual’s welfare is influenced only by changes in her nominal income and consumption prices. In addition, I make a hypothesis that individual possesses exactly one unit of either high-skilled or low-unskilled labour, and a positive amount of capital. All individuals are assumed to have identical utility (welfare) functions. Following Mayer’s (1984) approach for calculating median voter utility change after the imposition of a tariff, I obtain the utility change for the inflow of immigrants\textsuperscript{11}:

\[
\frac{\partial U^i}{\partial V_j} = \frac{\partial U^i}{\partial y} \left( \frac{\hat{R}_N R_N V^i_N}{\hat{V}_j V_j} + \frac{\hat{R}_h R_h V^i_h}{\hat{V}_j V_j} \right), \quad j = E, D, \quad h = E, D \quad (18.1)
\]

where \( h \) is individual’s \( i \) association with either type of specific labour.

Taking into account perfect international capital mobility \((\hat{R}_N = 0)\) and the fact that each individual owns exactly one unit of labour \((\hat{V}^i_h)\), equation (18.1) transforms into:

\[
\frac{\partial U^i}{\partial V_j} = \frac{\partial U^i}{\partial y} \frac{\hat{R}_h R_h}{\hat{V}_j V_j}, \quad j = E, D, \quad h = E, D \quad (18.2)
\]

Thus, to know the attitude of a particular individual toward the inflow of low-skilled and high-skilled labour, it is sufficient to establish the direction of change in her labour income after immigration. Since the majority may be represented by high-skilled or low-skilled voters, I need to obtain the signs of \( \frac{\hat{R}_D}{\hat{V}_D}, \frac{\hat{R}_D}{\hat{V}_E}, \frac{\hat{R}_E}{\hat{V}_D}, \frac{\hat{R}_E}{\hat{V}_E} \). According to equations (7) and (8),

the wage of either specific labour depends both on changes in factor supplies and changes in domestic price (the price for exported good is assumed to be constant). As the immigration of foreign workers leads to FDI flows, and both labour and capital flows modify domestic non-traded good price, the growth of the price of specific factor can be expressed as follows:

\textsuperscript{10} However, see e.g. Schiff (2002), Mayda (2005) and O’Rourke and Sinnott (2004) for the theoretical and empirical analysis if non-economic factors influencing attitudes towards immigrants.

\textsuperscript{11} See Ivlevs (2005), appendix A.7.
\[ \hat{R}_b = f_\{\hat{p}_D(\hat{v}_j, \hat{v}_N)\hat{v}_j, \hat{v}_N(\hat{v}_j)\} \quad j = D, E \]

The analysis in the previous chapter suggests that high-skilled immigrants raise price of the non-traded good, and the low-skilled decrease it. Even if the consecutive capital flows may change the non-traded good price in the opposite direction, the immigration effect will be dominant\(^{12}\). Table 1 displays the sign of the effect that immigration, FDI flows and domestic price exert on specific labour wage.

<table>
<thead>
<tr>
<th></th>
<th>( \hat{R}_D )</th>
<th>( \hat{R}_E )</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-skilled immigration</td>
<td>( V_F \to V_N, p_D ) (( i ))</td>
<td>- + +</td>
</tr>
<tr>
<td>Low-skilled immigration, ( \sigma &gt; \sigma_D )</td>
<td>( V_D \to V_N, p_D ) (( i ))</td>
<td>- + -</td>
</tr>
<tr>
<td>Low-skilled immigration, ( \sigma &lt; \sigma_D )</td>
<td>( V_D \to V_N, p_D ) (( i ))</td>
<td>- - -</td>
</tr>
</tbody>
</table>

Table 1. Specific factor returns and immigration.

The aggregate effect is unambiguous only in the case of \( \frac{\hat{R}_D}{V_D} \) (if \( \sigma < \sigma_D \)): the wage (or welfare) of the low-skilled individual decreases with the inflow of immigrants of the same type given that domestic non-traded and imported goods are sufficiently weak substitutes. Using equation (5) and keeping in mind that \( \hat{p}_E = \hat{R}_N = 0 \) in final equilibrium, one can show that \( \frac{\hat{R}_E}{V_D} = 0 \) independently of the level of \( \sigma \); in this case, positive effects outweigh negative ones, and welfare of high-skilled voter will not be affected by low-skilled immigration.

Remain the cases of \( \frac{\hat{R}_D}{V_E} \), \( \frac{\hat{R}_E}{V_E} \) and \( \frac{\hat{R}_D}{V_D} \) (if \( \sigma > \sigma_D \)), which must be solved for algebraically.

For this, I substitute equations (15), (16.2) and (17) into equations (7) and (8). Simplifying\(^{13}\) yields a positive value for \( \frac{\hat{R}_D}{V_E} \), a negative value for \( \frac{\hat{R}_D}{V_D} \) (irrespectively of the value of \( \sigma \)).

\(^{12}\) See app. A.2- A.4 for the formal proof.

\(^{13}\) See appendix.
The sign of $\frac{\hat{R}_E}{\hat{V}_E}$ depends on the value of $\Delta$. If $\Delta$ is higher (lower) than 1, nominal wage of the skilled workers goes down (up) with the inflow of high-skilled immigrants. This corresponds to the equation (8) where lower levels of $\Delta$ reinforce the positive effect stemming from capital inflow on $R_E$. Alternatively, positive effect from capital inflow outweighs negative effects from higher supply the high-skilled and higher non-traded good price, if $\Delta$ is inferior to 1.

The changes in factor prices due to immigration are directly transmitted the preferences of native individuals over foreign labour inflow. According to equation (18.2) the voter will be for (against) the inflow of immigrants, if the nominal income of the specific labour that she owns goes up (down). Table 2 summarises the findings about the direction of change of specific factor prices, showing the stance taken by the median voter vis-à-vis low-skilled and high-skilled immigrants.

<table>
<thead>
<tr>
<th>Immigrants</th>
<th>Median voter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low-skilled</td>
</tr>
<tr>
<td>Low-skilled</td>
<td>Against</td>
</tr>
<tr>
<td>High-skilled</td>
<td>For</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Natives’ attitudes towards immigration.

As mentioned above, the attitudes on immigration are based exclusively on the variation of personal income. Indeed, it is almost impossible to find an individual voting for the removal of migration barriers, if her welfare decreases with immigration. However, a particular case of indifferent stance towards immigrants deserves more attention. The above-mentioned results suggest that the high-skilled median voter would be indifferent to the inflow of low-skilled foreign workers because there is no change in her nominal income. In this case these voters could take into consideration other effects from immigration, both of economic and non-
economic nature and become pro- or anti-immigrant. For example, the inflow of low-skilled immigrants leads to the change in capital stock of the economy, with the direction of change depending on the level of $\sigma$. More capital means the expansion of production possibilities and higher strong prospects, and vice versa, therefore, I would assume that the natives prefer inward capital flows to the outward ones. Again, I consider only economic effects of capital flows (new working places, growth etc.), ignoring all non-materialistic arguments, as I did for the case of labour flows. Thus, high-skilled median voter will favour (oppose) low-skilled immigration, if it will bring about foreign capital inflow, that is, if the elasticity of substitution between imported and non-traded good falls short of (exceeds) the elasticity of factor substitution in non-traded good sector.

6. CONCLUSIONS

Contrary to the rapid trade and capital flows liberalization, international labour flows are often determined by restrictive immigration policies. In such a situation labourers’ wages systematically fall short of those in host countries, whereas free international movement of capital tend to assure equalization of capital price across countries. Another reason for asymmetry between labour and capital flows consists in higher physical, human and economic costs of migration. This can explain the speed with which different factors cross borders for better employment opportunities. Relying on these asymmetries, I assume that capital flows respond endogenously to any exogenous migration shock (represented, for example, by the increase in immigration quota), and try to determine whether international high-skilled and low-skilled labour on the one hand and capital flows on the other are complements or substitutes.

I find that the inflow of high-skilled immigrants always induces an inward flow of FDI, meaning the two are complements. On the other hand, low-skilled immigration may cause an outflow of capital, if domestic non-traded good and imported good are sufficiently weak substitutes in consumption, implying a factor flows are substitutes in quantity sense.

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14 Compared to the change in nominal income, other economic and non-economic effects from immigration can defined as those of “second order”. They become decisive only if the “first order” effect, or change in individual’s nominal income” is equal to zero.

15 One could easily argue that some natives simply do not like any inflow of foreign capital, even if it contributes to the welfare of the economy.
Since the results of the model can be applied to immigration and emigration, some conclusions can be drawn concerning the aggregate welfare in sending countries. The outflow of high-skilled individuals is particularly disastrous for the economy, since it leads to net capital outflow. On the contrary, low-skilled emigration may result in net FDI inflows, if non-traded and imported goods are weak substitutes. Therefore, taking the example of the enlarged EU, governments of the new member states should prevent the outflow of high-skilled workers, in order to avoid capital outflow.
SELECTED REFERENCES


Appendix.

A.1. To prove that $\beta_D \frac{\alpha_N}{(\sigma + \Omega)} + \frac{1}{\Delta}$ is positive.

$$\beta_D \frac{\alpha_N}{(\sigma + \Omega)} + \frac{1}{\Delta} = \beta_D \frac{1}{\Delta} \left( \frac{\theta_{ND} \sigma_D - \theta_{NE} \sigma_E}{\theta_{EE}} \right) + \frac{1}{\Delta} =$$

$$= \frac{1}{\Delta} \left[ -\beta_D \left( \frac{\theta_{NE} \sigma_E}{\theta_{EE}} \beta_D - \theta_{ND} \frac{\sigma_D}{\theta_{DD}} \beta_D \right) \right] + 1$$

With all parameters positive, the ratio $\left( \frac{\theta_{NE} \sigma_E}{\theta_{EE}} \beta_D - \theta_{ND} \frac{\sigma_D}{\theta_{DD}} \beta_D \right)$ cannot be superior to $\left( \theta_{NE} \frac{\sigma_E}{\theta_{EE}} \beta_D + \theta_{ND} \frac{\sigma_D}{\theta_{DD}} \beta_E \right)$

1. Multiplying it by $\beta_D$, which by definition is positive and less than one, and subtracting the product from 1 gives some positive value.

A.2. To prove that $\hat{R}_D$ is positive:

Insert equation (16.2) into (7):

$$\hat{R}_D = \left[ \beta_D + \frac{1}{\theta_{DD}} \beta_E \right] - \frac{1}{(\sigma + \Omega)} (\alpha_E \hat{V}_E + \alpha_N \hat{V}_N) + \frac{1}{\Delta \theta_{DD}} (\hat{V}_N - \lambda_{NE} \hat{V}_E) =$$

$$= \hat{V}_E \left( \beta_D + \frac{1}{\theta_{DD}} \beta_E \right) - \frac{1}{(\sigma + \Omega)} (\alpha_E + \alpha_N) \left( -\beta_D \frac{\alpha_E}{(\sigma + \Omega)} + \frac{\lambda_{NE}}{\Delta} \right) + \frac{1}{\Delta \theta_{DD}} \left( -\beta_D \frac{\alpha_E}{(\sigma + \Omega)} + \frac{\lambda_{NE}}{\Delta} \right).$$

(1)
Evaluate separately expressions (1) and (2):

1) 

\[
\alpha_E + \alpha_N \left( -\beta_D \frac{\alpha_E}{(\sigma + \Omega)} + \frac{\lambda_{NE}}{\Delta} \right) = \left( \beta_D \frac{\alpha_N}{(\sigma + \Omega)} + \frac{1}{\Delta} \right) \left( \alpha_E + \alpha_N \lambda_{NE} \right)
\]

The denominator \( \left( \beta_D \frac{\alpha_N}{(\sigma + \Omega)} + \frac{1}{\Delta} \right) \) is positive (see A.1), collecting terms in nominator yields:

\[
\alpha_E + \alpha_N \lambda_{NE} = -1 - \lambda_{NE} \frac{1}{\Delta} \left( \frac{\theta_{ND} \sigma_D}{\theta_{DD}} - \frac{\theta_{NE} \sigma_E}{\theta_{EE}} \right) + \lambda_{NE} \frac{1}{\Delta} \left( \frac{\theta_{ND} \sigma_D}{\theta_{DD}} - \frac{\theta_{NE} \sigma_E}{\theta_{EE}} \right) = -1
\]

Thus, expression (1) is negative.

2) 

\[
\frac{\left( -\beta_D \frac{\alpha_E}{(\sigma + \Omega)} + \frac{\lambda_{NE}}{\Delta} \right)}{\left( \beta_D \frac{\alpha_N}{(\sigma + \Omega)} + \frac{1}{\Delta} \right)} - \lambda_{NE} = -\frac{\beta_D}{(\sigma + \Omega)} \left( \frac{\alpha_E + \lambda_{NE} \alpha_N}{\alpha_N + 1} \right) = \frac{\beta_D}{(\sigma + \Omega)} > 0
\]

\( \Rightarrow \) the coefficient of \( \hat{V}_E \) in the initial equation is positive \( \Rightarrow \frac{\hat{R}_D}{\hat{V}_E} > 0 \).

A.3. to prove that \( \frac{\hat{R}_D}{\hat{V}_E} \) is negative:

Insert equation (17) into (7):
\[ \hat{R}_D = \left[ \beta_D + \frac{1}{\theta_{DD}} \beta_E \right] \left( \frac{1}{\sigma + \Omega} \left( \alpha_D \hat{V}_D + \alpha_N \hat{V}_N \right) \right) + \frac{1}{\Delta \theta_{DD}} \left( \hat{V}_N - \lambda_{ND} \hat{V}_D \right) = \]

\[
= \hat{V}_D \left[ \frac{\beta_D + \frac{1}{\theta_{DD}} \beta_E}{\sigma + \Omega} \right] \left( -1 \right) \left( \alpha_D + \alpha_N \right) \left( \frac{-\beta_D \alpha_D}{\sigma + \Omega} + \frac{\lambda_{ND}}{\Delta} \right) + \frac{1}{\Delta \theta_{DD}} \left( \frac{-\beta_D \alpha_D}{\sigma + \Omega} + \frac{\lambda_{ND}}{\Delta} \right) \]

\[
(1) + \frac{1}{\Delta \theta_{DD}} \left( \frac{-\beta_D \alpha_N}{\sigma + \Omega} + \frac{1}{\Delta} \right) - \lambda_{ND} \]

\[ \hat{R}_E = -\frac{\theta_{NE}}{\theta_{EE}} \beta_D \left( \frac{1}{\sigma + \Omega} \left( \alpha_E \hat{V}_E + \alpha_N \hat{V}_N \right) \right) + \frac{1}{\Delta \theta_{EE}} \left( \hat{V}_N - \lambda_{NE} \hat{V}_E \right) = \]

\[
= \hat{V}_E \left[ \frac{\theta_{NE}}{\theta_{EE}} \frac{\beta_D}{\sigma + \Omega} \right] \left( \alpha_E + \alpha_N \right) \left( \frac{-\beta_D \alpha_E}{\sigma + \Omega} + \frac{\lambda_{NE}}{\Delta} \right) + \frac{1}{\Delta} \left( \frac{-\beta_D \alpha_E}{\sigma + \Omega} + \frac{\lambda_{NE}}{\Delta} \right) \]

\[
= \hat{V}_E \left[ \frac{\theta_{NE}}{\theta_{EE}} \frac{\beta_D (1-\Delta)}{(\sigma + \Omega) \left( \alpha_N \beta_D + \frac{1}{\Delta} \right)} \right] \]

It is easy to prove that expression (1) is positive and (2) is negative (see app. A.2. for similar calculus). Therefore, \( \frac{\hat{R}_D}{\hat{V}_D} \) is necessarily negative.

A.4. to obtain the sign of \( \frac{\hat{R}_E}{\hat{V}_E} \)

Insert equation (16.2) into (7) and simplify:

\[ \hat{R}_E = -\frac{\theta_{NE}}{\theta_{EE}} \beta_D \left( \frac{1}{\sigma + \Omega} \left( \alpha_E \hat{V}_E + \alpha_N \hat{V}_N \right) \right) + \frac{1}{\Delta \theta_{EE}} \left( \hat{V}_N - \lambda_{NE} \hat{V}_E \right) = \]

\[= \hat{V}_E \left[ \frac{\theta_{NE}}{\theta_{EE}} \frac{\beta_D}{\sigma + \Omega} \right] \left( \alpha_E + \alpha_N \right) \left( \frac{-\beta_D \alpha_E}{\sigma + \Omega} + \frac{\lambda_{NE}}{\Delta} \right) + \frac{1}{\Delta} \left( \frac{-\beta_D \alpha_E}{\sigma + \Omega} + \frac{\lambda_{NE}}{\Delta} \right) \]

\[= \hat{V}_E \left[ \frac{\theta_{NE}}{\theta_{EE}} \frac{1}{(\sigma + \Omega) \left( \beta_D \alpha_N + \frac{1}{\Delta} \right)} \right] \]