SPILLOVERS BETWEEN SKILLED AND LOW SKILLED LABOR MIGRATION IN A MULTI-REGIONAL SETTING

by

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ABSTRACT

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We analyze spillover effects arising due to movements of skilled and low skilled labor in a static multi-regional model featuring three factors of production: capital, labor, and land (an immobile factor). While capital is perfectly mobile, labor from one region can migrate to another with some origin-destination specific probability (induced by the associated immigration policies) after incurring fixed costs and skill specific efficiency losses both of which are determined by the origin and destination. In this setting, we characterize not only competitive equilibrium allocations of factors of production but also the associated migration levels. Furthermore, we show that policies of host regions favoring skilled labor from one particular region may trigger movements of low skilled labor from other regions even when all the other parameters, including those concerning low skilled labor movement costs, remain the same.

ÖZET

ÇOK BÖLGELİ MODELDE NİTELİKLİ VE VASIFSIZ İŞÇİ GÖÇÜNÜN KARŞILIKLI ETKİLEŞİMİ

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Bu tezde, çok bölgeli statik bir model önerilmekte ve bu modeli kullanarak nitelikli ve vasıfsız işçi göçlerinin birbiri üzerine yayılma etkisi incelemektedir. Modelde, üç üretim faktörü bulunmaktadır: sermaye, işçi ve toprak (hareketsiz faktör). Sermaye hareketini engelleyen hiç bir engel yok iken, işçiler bulundukları bölgeden başka bir bölgeye göç etmeleri, başlangıç ve varış noktasına dayalı bir olasılığa bağlıdır. Aynı zamanda, işçiler göç sonrası başlangıç ve varış noktasına dayalı verimlilik kaybına uğramakta ve sabit bir masraf ödeme zorundadırlar. Böyle bir durumda, üretim faktörlerinin rekabetçi dengedeki dağılımları ve ilgili göç seviyeleri belirlenmektedir. Bu çalışmada gösterilmiştir ki göç kabul eden bölgelerin belirli bir bögeden nitelikli işçi göçünü kolaylaştıtmak için yaptıklari politika değişiklikleri, başka bir bölgeden, bu bölgedeki vasıfsız işçileri ilgilendiren parametreler aynı kalsa dahi, vasıfsız işçi göçünü tetikleyebilmektedir.

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CHAPTER 1

INTRODUCTION

An important question in economics concerns the labor market impact of immigration. Even though migrants might seem as burden on natives, it might be that in some cases they may be the accelerator of the future growth of the countries. In this regard, by aiming to increase the welfare of their citizens, countries search for immigration policies that maximize their economic benefits. In this thesis, we analyze the economic implications of two such policies: integration of migrants to labor market and visa granting policies.

On the negative side, immigrants bring about adverse effects on native workers: increase in the immigration lead to expand in the labor supply, which in return decreases the price of labor, i.e. wages. Also, immigrants raise the cost of public services; because the demand for public education, health, transportation, etc. will be increased. Since these costs are paid by the citizens of the host country, immigrants may aggravate the tax burden on natives. These two factors are the main reasons for natives to be against migration (Hainmueller & Hiscox, 2010; Mayda & Facchini, 2006).

In contrast, the public (of the host country) supports skilled migration much more than the migration of low skilled workers (Hainmueller & Hiscox, 2010; Facchini & Mayda, 2012). This is because the benefit from skilled migrants appear to be higher than its costs; hence, skilled labor migration provides the host country with a positive immigration surplus.

Firstly, skilled migrants have positive externalities on other workers. Since migration is non-random, it is expected that people who want to migrate are the more able

people. This so called self-selection effect (Borjas, 1987) leads to increase in efficiency. Indeed, Peri (2012) shows that migration improves the total factor productivity of the host country. One explanation is that with skilled migrants being more concentrated in science and engineering and them being more able thanks to self-selection lead to boost innovation in the host country. Hunt and Gauthier-Loiselle (2010) demonstrate that a percentage expansion in post-college immigrants has two times higher impact on per capita patent numbers than the one percentage post college native expansion. These aspects of skilled migrants positively affect the long run growth of the host country.

Secondly, more educated people are less likely to use public services and pay more taxes. Hence, their benefit is higher than their cost for governments. Storesletten (2000) calculates that net present value of representative high skilled migrant as $\$96,000$; whereas this figure is $\$-2,000$ and $\$-36,000$ for the medium and the low skilled migrant, respectively.

Importance of human capital for growth, positive externalities on native workers, and increases in tax revenues result in governments to want to attract high skilled immigrants (Aydemir, 2013; Kapur & McHale, 2005). Moreover, ageing population and the slow growth rate of labor force in rich countries raises the popularity of attractiveness of skilled migrants (Ferrer, Picot, & Riddell, 2014). By adopting policies that attract the skilled persons to migrate, countries might ameliorate their welfare.

In this regard, some countries such as Canada, Australia, United Kingdom, Germany, adopted admission policies that attract high skilled migrants. One possible way to do this is giving priority to the high educated people. While granting visas, a college graduate should have higher acceptance rate than a high school drop-out. Secondly, countries may change the nation-mix of the migrants. By accepting migrants from countries with higher (average) level of education, they would broaden the portion of the high skilled labor in the migrants.

Another aspect of skilled migration is the labor market integration. Although by admission policies high skilled migrants might be attracted, there might be imperfect skill transferability due to differences in culture, language, labor market structures. These differences may undermine the efficiency of the migrants which results in lower wages. A branch of studies shows that newly arrived immigrants earn lower wages than natives (Aydemir & Skuterud, 2005; Borjas, 1985; Card, 2005; Ferrer et al., 2014). It is stated

that this wage gap narrows down in time thanks to the integration of the migrants into the labor market. Hence, an immigrant considers this efficiency loss and wants to move where this loss is minimum.

Therefore, there exist two policy channels to attract high skilled immigrants. First is to favor high educated people when granting visas and work permits, and the second is to expedite and improve the associated labor market integration. While the first of these two policies is generally implemented by designing visa granting policies to various countries and skill levels accordingly; the second involves implementing policies calling for opening courses that teaches migrants language and cultural aspects in order to expedite and improve intehration into the host country. For example, Britain reached the cap on the visas that granted to high skilled labor (Travis, 2015). In order them to enlarge the high skilled labor base, they need to change the visa granting scheme. In Germany, on the other hand, the supply of language courses for migrants far below than the demand for them (Integration Courses, 2010, 25 October). Consequently, this discourages skill labor from migrating to Germany. Hence, they need to adapt integration courses to meet the demand.

A recent and related literature focuses on the potential gains from the elimination of the barriers to labor movements. Even though the first of such simulations was conducted in 1984, this analysis has attracted significant attention only in 2000's. In their inspirational paper, Hamilton and Whalley (1984) estimates the growth in the world output. 20 years later, J. W. Moses and Letnes (2004) replicates their study with a new dataset and later they compare the alternative liberalization policies to available migration data and calculate the possible per migrant gains (2005). Main argument of these studies is that when the barriers to labor movement are eliminated, people would move to regions where wages are higher. The equilibrium distribution of the labor force should be such that wages in all of the regions should be equalized. So, they found the distribution of labor force across regions that equalize the marginal productivity of labor is equalized everywhere and then calculate the outputs in each region in this new labor force distribution. Iregui (2003) develops a model where there exist two types of labor (skilled and unskilled) and each country produces one distinct commodity good, which enable them to consider the international trade. All of these studies examine a static model. Klein and Ventura (2007, 2009) and Delogu, Docquier, and Machado (2014) uses dynamic models to in-

vestigate the efficiency gains from elimination of restriction on labor movement. Klein and Ventura (2007) considers the efficient distribution of labor force across two region: rich and poor. Correspondingly, they solve the social planner problem and analyze the effect of TFP differences between regions, which accused to bring about the variations in labor movements. In their 2009 paper, Klein and Ventura examine the competitive market equilibrium in a three factor (capital, land, labor) growth model while labor consists of only one type. The effect of liberalization on the education level and fertility decision of individuals analyzed by Delogu et al. (2014). As Clemens (2011) refers these findings as "Trillion Dollar bills on the side-walk"; all of these studies find substantial gain from labor market liberalization. The literature suggests that reducing the barriers to movement would increase the GDP of world from 20% to 122%. In a recent study, Giovanni, Levchenko, and Ortega (2015) looking at the opposite direction, analyze the possible impact of a full restriction of migration. Their model includes the effect of remittances and international trade. They estimated that observed level of migration today account for 10% increase in the welfare of individuals, comparing the counter factual scenario in which there were no migration.

The efficiency loss of migrants is examined in some of these studies, however they assumed that efficiency losses are independent of host and source countries (Klein & Ventura, 2007, 2009; Iregui, 2003; Giovanni et al., 2015). Even though some of them considers heterogeneous labor (Klein & Ventura, 2007; Giovanni et al., 2015; Delogu et al., 2014), only Iregui (2003) regards the situation in which only skilled labor can migrate. Moreover, apart from Iregui (2003), none of the other studies focus on bilateral migration policies, they take only the global liberalization into consideration. However, bilateral agreements are more possible in reality. For example, with bilateral agreements, Germany accepted guest workers from Italy, Turkey and Greece in 1960s. Furthermore, these studies are reluctant to emphasize the size of the movements in such scenarios (Borjas, 2015). Klein and Ventura (2009) state that 99% of the population in the poor countries are supposed to migrate to rich countries in the equilibrium. Possible impact of huge movements does not discussed in detail even though this amount of movement can bring about big social problems.

In this paper, we analyze spillover effects between movements of skilled and low skilled labor in a static multi-country framework under competitive equilibrium featuring

three factors of production: capital, labor, and land. In our setting capital is freely mobile, land is immobile and labor, composed of skilled and low skilled workers, is restricted in mobility via skill specific visa policies and efficiency losses. It turns out that the design of policies has to be carefully conducted. This is because "intuitive" policies aiming to attract high skilled migrants from one country, due to these spillover effects may lead to reverse the desired effects, by triggering the movement of low skilled labor from another country.

In our model, every one of the regions possesses a continuum of agents. An agent initially located in one region possesses initial endowments of capital, land and labor, where his labor may be of one of the following two types: high skilled or low skilled.

Freely mobile capital implies that each agent, which can be located in any regions initially, can freely invest in any one of the regions he desires.

On the other hand, restricted labor mobility is modeled as follows. When an agent initially located in a region aims to move to another country, first he faces a probability of acceptance. This probability, specific to origin-destination and the skill type under analysis, determines the likelihood with which this agent's attempt would be successful. Notice that, therefore, there is a probability that an agent cannot move even when he wishes to migrate to another country. Secondly, when he migrates to another country, the agent in question will lose some of his efficiency due to the imperfect skill transferability. This corresponding efficiency loss depends on the origin and the destination and the skill type of the agent. The third restriction regarding labor mobility involves a (real) fixed cost of moving which is also related to the origin and the destination and the skill type of the migrating agent.

The third factor of production, land, is owned by the agents. Clearly, this production factor is not mobile. As we employ the notion of competitive equilibrium in the current study, we do not model the trade of (buying/selling) land. Indeed, when an agent moves from one country to another, he keeps his land in the country of origin and collects the resulting rents without any frictions.

Each county produces a homogeneous consumption good using the same production function with different total factor productivity figures across countries. An important, yet standard, restriction employed in the current study concerns the inability of firms to delegate production to other countries. While the trade of consumption good across

regions is not restricted, the delegation of production to other locations is not allowed. The production in a given country is as in Borjas (2003) and uses the following two stage constant elasticity of substitution production function adopting the convention that natives and immigrants have the same skill level and are perfect substitutes (of course, up to the associated efficiency losses), which is consistent with the findings of Borjas, Grogger, and Hanson (2012). In the first stage labor in each skill level is aggregated into the efficiency unit. Then, in the second stage, using the resulting aggregated efficiency labor unit, we have the production function of a county in standard constant returns to scale Cobb-Douglas form.

In competitive equilibrium, the prices of production factors, interest rates and wages and rent for land are given by their corresponding marginal productivity.

As a consequence, the best responses of an individual initially located in one of the countries, would call for that agent attempting migration to another country if the (expected) gains from migration exceeds the costs.

As in other standard macroeconomics models, here the level of prices of production factors in a country affects the amount of production factors in that country. E.g. wages to low skilled (high skilled) labor in a country affect the mass of low skilled (high skilled, respectively) labor force in the same country.

However, in our model the story does not end there: It is essential to notice that the marginal productivity of a production factor in a given country is affected by the mass of other production factors in the same country. E.g. the wages to skilled labor (low skilled) force in a country is affected by the amount of low skilled (skilled, respectively) labor force in the same country. Combining this observation with the one given in the previous paragraph constitutes precisely the origin of the spillover effects between skilled labor and unskilled labor that the current study analyzes. Also the model involving multiple regions implies that the problem at hand is beyond the identification of a fixed point with two countries.

In this setting, we define and identify the competitive (Walras) equilibrium and analyze the resulting implications on the distribution of skilled and low skilled labor and capital across countries. This, in turn, is used to analyze welfare implications across countries.

We show that the spillover effects between skilled labor and unskilled labor are

significant in competitive equilibrium. To that regard we present two examples both of which are taken from the real-world.

In the first example, considering Germany integration policy, we analyze the effect of alleviating efficiency losses concerning high skilled labor from only one country. We show that a policy change designed to alleviate efficiency losses for high skilled workers from Poland, triggers a migration of low skilled labor from Czech Republic. This example also depicts the so-called network effect: Even though there are no changes concerning policies and frictions between Germany and Czech Republic, the reduction of frictions between Germany and Poland regarding only the skilled labor triggers a wave of migration of low skilled labor from Czech Republic.

In our second example, another three country setting involving the real-world data, the situation between Canada and Mexico and the USA is analyzed. We show that by allowing some low skilled labor from Mexico to come and work in the USA initiates high skilled labor from Canada to migrate to the US as well even if this migration were to involve a fixed cost.

This paper is organized as followed: in the second chapter we present the model and in the third we provide the definition of competitive equilibrium. Forth chapter displays our simulation results concerning the reduction of efficiency losses using data from Germany and Poland and Czech Republic. The fifth chapter provides our results from simulations of visa policy relief using the US and Canada and Mexico data. In the sixth chapter we conclude.

CHAPTER 2

THE MODEL

Let $N = \{1, \ldots, n\}$, $n \in \mathbb{N}$, denote the set of nodes (regions or locations).

T_i, a non-empty convex and compact subset of $\mathbb{R}$ for each $i \in N$, denotes the set of agents initially located in node i. Each agent $t \in T_i$, is endowed with $\bar{k}_i(t) \in \mathbb{R}_+$ amounts of capital and $\bar{f}_i(t) \in \mathbb{R}_+$ amounts of land, in turn delivering functions $\bar{\mathbf{k}}_i : T_i \to \mathbb{R}_+$ and $\bar{\mathbf{f}}_i : T_i \to \mathbb{R}_+$ which are assumed to be bounded and measurable. Each $t \in T_i$ has 1 (efficiency) unit endowment of either of the following two types of labor: high skilled or low skilled, denoted by $s \in \{\ell, h\}$; ℓ for low skilled and h for high skilled. For any given $t \in T_i$, we let $s_t \in \{\ell, h\}$ be the type of labor agent t has.

Therefore, each node $i \in N$ possesses four types of mass: (i) mass of low skilled labor $\bar{L}_i = \int_{t \in T_i} \mathbf{1}_{\{s_t = \ell\}} \mathrm{d}t$; (ii) mass of high skilled labor $\bar{H}_i = \int_{t \in T_i} \mathbf{1}_{\{s_t = h\}} \mathrm{d}t$; (iii) mass of capital $\bar{K}_i = \int_{t \in T_i} \bar{\mathbf{k}}_i(t) \mathrm{d}t$; (iv) and mass of land $\bar{F}_i = \int_{t \in T_i} \bar{\mathbf{f}}_i(t) \mathrm{d}t$. Notice that the definition of the index function and $\bar{\mathbf{k}}_i : T_i \to \mathbb{R}_+$ and $\bar{\mathbf{f}}_i : T_i \to \mathbb{R}_+$ being bounded and measurable imply that $\bar{L}_i, \bar{H}_i, \bar{K}_i, \bar{F}_i \in \mathbb{R}_+$.

In our model, capital is freely mobile and land is immobile. The mobility of labor, on the other hand, is restricted and involves three types of frictions: (i) efficiency losses; (ii) regions' migration policies; and (iii) fixed costs of migration. Let $C^s_{ij} \in [0,1]$ denote the efficiency unit of labor of an agent initially located in region i having a skill level s and working in region j. In other words, $(1 - c^s_{ij})$ identifies the efficiency loss of labor of type s when he/she migrates from i to j. Regions migration policies determine $\pi^s_{ij} \in [0,1]$, the probability of workers with skill level s from region i being accepted by region j. This

parameter captures visa policies of regions and higher levels mean that regions are more open for labor movements. Finally, $M_{ij}^{s} \geq 0$ is the fixed cost of migration (in real terms) of an agent from region i having labor of type s migrating to region j. Notice that all of these frictions depend on the host and source regions and skill levels.

Each location involves the production of the homogeneous consumption good. Indeed, every location has the same production function with different total factory productivity figures across regions. An important, yet standard, restriction employed in the current study concerns the inability of firms to delegate production to other regions. While the trade of consumption good across regions is not restricted, the delegation of production to other locations is not allowed.

The production in a given region is modeled following Borjas (2003) [1]. We use a two stage constant elasticity of substitution production function and assume that natives and immigrants having the same skill level are perfect substitutes (up to the associated efficiency losses), which is consistent with the findings of Borjas et al. (2012).

In the first stage labor in each skill level is aggregated into the efficiency unit. Let Q_i be the efficiency unit of labor in region i and defined by

$$Q_i(\ell_i, h_i) = (\alpha \ell_i^{\rho} + (1-\alpha) h_i^{\rho})^{1/\rho} \tag{2.1}$$

where $\rho = 1 - 1/\sigma_{\ell h}$ and $\sigma_{\ell h}$ is the elasticity of substitution between low skilled and high skilled labor and α is the efficiency parameter and ρ captures the substitution between high skilled and low skilled labor.

In the second stage, using the above given aggregated efficiency labor unit, we have the production function of location i in constant returns to scale Cobb-Douglas form:

$$Y_i(\ell_i, h_i, K_i, F_i) = A_i Q_i(\ell_i, h_i)^{\eta} K_i^{\lambda} F_i^{1-\lambda-\eta}$$

where Y_i is the total output and A_i the TFP of region i, and $\eta, \lambda \in (0,1)$ are such that $\eta + \lambda < 1$. Consequently, given wages w_i^s of location i for skill level s and r_i^f the rental rate of land in i and r_i^k the interest rate of capital in region i, the profit of a firm located in

[1] Borjas (2003) uses three level CES framework, though here we assume that natives and immigrants are perfect substitute for any given skill level. Hence, the third stage is simple summation.

i is given by:

$$Y_i(\ell_i, h_i, K_i, F_i) - w_i^{\ell}\ell_i - w_i^{h}h_i - r_i^{k}K_i - r_i^{f}F_i, \tag{2.2}$$

While the current presentation involves these parameters being constant across regions (as is done in other related studies), generalizing our model by weakening this aspect is an easy exercise.

Before presenting our equilibrium concept, the notion of competitive equilibrium applied to the current setting, we wish to discuss agents' migration decisions.

Given wages $\mathbf{w}^s = (w_j^s)_{j\in N}$ for skill level $s \in \{\ell, h\}$ and $\mathbf{r}^f = (r_j^f)_{i\in N}$ and $\mathbf{r}^k = (r_j^k)_{j\in N}$ the interest rate profile where each component corresponds to the interest rate of capital in the associated region, an agent initially located in region i, $t \in T_i$, with skill level $s \in \{\ell, h\}$ earns the following real term (in consumption goods) if he/she were to decide to stay in i

$$w_i^s + \mathbf{r}^k \cdot \mathbf{k}_i(t) + r_i^f \bar{\mathbf{f}}_i(t), \tag{2.3}$$

where $\mathbf{k}_i(t) : T_i \to \mathbb{R}_+^n$ describes the investment behavior of $t \in T_i$ while $\mathbf{k}_{ij}(t) \in \mathbb{R}_+$ identifies his/her investment to region j and feasibility requires $\mathbf{k}_{ij}(t) \in [0, \bar{\mathbf{k}}_i(t)]$ for all j and $\sum_j \mathbf{k}_{ij}(t) \leq \bar{\mathbf{k}}_i(t)$. On the other hand, if he/she were to choose to migrate to region $j \neq i$, then he/she earns the real term given by

$$\pi_{ij}^s \left(w_j^s + \mathbf{r}^k \cdot \mathbf{k}_i(t) + r_i^f \bar{\mathbf{f}}_i(t) - M_{ij}^s \right) + (1 - \pi_{ij}^s) \left(w_i^s + \mathbf{r}^k \cdot \mathbf{k}_i(t) + r_i^f \bar{\mathbf{f}}_i(t) \right). \tag{2.4}$$

Observe that we do not allow agents to allocate some portions of their labor to different locations and restrict attention to situations where they can work and reside in only one region. On the other hand, agents can distribute their capital arbitrarily across regions and collect a portfolio return of $\mathbf{r}^k \cdot \mathbf{k}_i(t)$. It may be useful to point out that we do not allow for short-sales. Moreover, agents keep getting the real return to their land (in their home region) regardless of where they work/reside.

Hence an agent $t \in T_i$, when deciding whether or not to move to another region, compares (2.3) with (2.4) for $j \neq i$. As a result, $t \in T_i$ strictly prefers attempting to migrate to region $j \neq i$ if:

$$c_{ij}^s w_j^s - \pi_{ij}^s M_{ij}^s > w_i \tag{2.5}$$

Therefore, $t \in T_i$ best responding to the givens of the model implies that he/she

would attempt to move to $j^* \in \text{argmax}_{j \in N}\{c_{ij}^{s_t} w_j^{s_t} - \pi_{ij}^{s_t} M_{ij}^{s_t}\}$ provided that condition (2.5) holds for some $j \neq i$.

In what follows, the term θ_{ij}^{s} denotes the mass of labor initially located in i and having a labor type s that attempts to migrate from i to j, $j \neq i$.

CHAPTER 3

COMPETITIVE EQUILIBRIUM

In this section, we will provide the definition of equilibrium, the notion of competitive equilibrium applied to the current setting.

Definition 1 *Given* $([C_{ij}^s],[\pi_{ij}^s],[M_{ij}^s])_{i,j\in N;s\in\{\ell,h\}}$ *and* $(A_i)_{i\in N}$ *and* $\bar{\mathbf{k}}_i : T_i \to \mathbb{R}_+$ *and* $\bar{\mathbf{f}}_i : T_i \to \mathbb{R}$, $i \in N$, *and* $\bar{\mathbf{k}}_i, \bar{\mathbf{f}}_i$ *both bounded and measurable, the profile* $[\theta_{ij}^s]_{i,j\in N}$, $\mathbf{w}^\ell$, $\mathbf{w}^h$, $\mathbf{r}^k, \mathbf{r}^f$ *and* $(h_i, \ell_i, \mathbf{k}_i)_{i\in N}$ *is a* ***competitive equilibrium*** *if:*

1. ***Agents' Problem:***

   (a) *If* $\theta_{ij}^s > 0$ *for* i, j *with* $i \neq j$, *then*

      $(i.)$ *either* $w_i^s = c_{ij}^s w_j^s - \pi_{ij}^s M_{ij}$,

      $(ii.)$ *or* $w_i^s < c_{ij}^s w_j^s - \pi_{ij}^s M_{ij}$ *and* $\theta_{ij}^s = \left(\int_{t\in T_i} \mathbf{1}_{\{s_t=s\}} \mathrm{d}t\right) - \sum_{k\neq j} \theta_{ik}^s$; *and*

   (b) *If* $w_i^s > c_{ij}^s w_j^s - \pi_{ij}^s M_{ij}$ *for* i, j *with* $i \neq j$, *then* $\theta_{ij}^s = 0$; *and*

   (c) $\mathbf{k}_i : T_i \to \mathbb{R}^n$ *is such that for all* $i \in N$ *and* $t \in T_i$, $(\mathbf{k}_{ij}(t))_{j\in N} \in \operatorname{argmax}_{(\kappa_j)_{j\in N}} \sum_{j\in N} r_j^k \kappa_j$ *subject to* $\kappa_j \in [0, \bar{\mathbf{k}}_i(t)]$ *for all* $j \in N$ *and* $\sum_{j\in N} \kappa_j \leq \bar{\mathbf{k}}_i(t)$.

2. ***Firm's Problem:***

   (a) $w_i^\ell = A_i \eta \alpha \ell_i^{\rho-1} Q_i^{\eta/\rho-1} K_i^\lambda F_i^{1-\beta-\gamma}$, *for all i.*

   (b) $w_i^h = A_i \eta (1-\alpha) h_i^{\rho-1} Q_i^{\eta/\rho-1} K_i^\lambda F_i^{1-\beta-\gamma}$, *for all i.*

   (c) $r_i^k = A_i \lambda K_i^{\lambda-1} Q_i^\eta F_i^{1-\eta-\lambda}$, *for all i.*

   (d) $r_i^f = A_i (1-\eta-\lambda) K_i^\lambda Q_i^\eta F_i^{-\eta-\lambda}$, *for all i.*

3. ***Feasibility:***

   (a) $\theta_{ij}^s \leq \int_{t\in T_i} \mathbf{1}_{\{s_t=s\}} \mathrm{d}t$, *for all* i, j *with* $i \neq j$; *and*

   (b) $\ell_i = \bar{L}_i + \sum_{j\neq i} c_{ji}^{\ell} \pi_{ji}^{\ell} \theta_{ji}^{\ell} - \sum_{j\neq i} \pi_{ij}^{\ell} \theta_{ij}^{\ell}$, *for all i; and*

   (c) $h_i = \bar{H}_i + \sum_{j\neq i} c_{ji}^{h} \pi_{ji}^{h} \theta_{ji}^{h} - \sum_{j\neq i} \pi_{ij}^{h} \theta_{ij}^{h}$, *for all i; and*

   (d) $K_i = \sum_j \left(\int_{t\in T_j} \mathbf{k}_{ji}(t) \mathrm{d}t \right)$, *for all i; and*

   (e) $F_i = \int_{t\in T_i} \bar{\mathbf{f}}_i(t) \mathrm{d}t$, *for all i.*

Following this definition, there are two important points:

Lemma 1 *In every competitive equilibrium, returns to capital should be equal in each region, i.e* $r_i^k = r_j^k$ *for all* $i, j \in N$.

Proof. Notice that portfolio decision in agents' problem is a linear problem. If this equality does not hold, then there exist $i \in N$ such that $r_i^k < r_j^k$ for some j, hence, no agent would invest in i since the return is higher in j. But then K_i would be zero, which leads the interest in region i to go infinity. This leads to contratiction. ■

Lemma 2 *In every competitive equilibrium,* $\theta_{ij}^s > 0$ *implies* $\theta_{ji}^s = 0$, $i, j \in N$ *and* $i \neq j$

Proof. From the agents' proglem, $\theta_{ij}^s > 0$ implies $w_i^s = c_{ij}^s w_j^s - \pi_{ij}^s M_{ij}$; hence $c_{ji} w_i^s - \pi_{ij}^s M_{ji}^s < w_j$ due to $c_{ij}^s < 1$ for all $1 \neq j$. ■

Our first lemma implies that what matters in competitive equilibrium is K_i, $i \in N$, and $\mathbf{k}_i : T_i \to \mathbb{R}^n$ can be chose arbitrarily as long as $K_i = \sum_j \int_{t\in T_j} \mathbf{k}_{ij}(t) \mathrm{d}t$. On the other hand, second lemma says that the direction of migration is one way: if there exist a flow of migrants from i to j in one skill level, there would be no migration flow from j to i within that skill level.

3.1. Cobb-Douglas Aggregation of Skill Level

Now we will consider the Cobb-Douglas aggregation of skill levels, i.e we assume that $\rho = 0$. In order to present a closed form solution, we also let $M_{ij}^s = 0$ for all $i, j \in N$ and $s \in \{\ell, h\}$.

In this case, the production function is

$$Y_i(\ell_i, h_i, K_i, F_i) = A_i K_i^{\lambda} \ell_i^{\beta} h_i^{\gamma} F_i^{1-\lambda-\gamma-\beta} \tag{3.1}$$

By definition of competitive equilibrium, if $\theta_{ij}^{\ell} > 0$ then:

$$\ell_j = \left[c_{ij} \left(\frac{A_j}{A_i}\right) \left(\frac{k_j}{k_i}\right)^{\lambda} \left(\frac{h_j}{h_i}\right)^{\gamma} \left(\frac{F_j}{F_i}\right)^{1-\lambda-\beta-\gamma} \right]^{\frac{1}{1-\beta}} \ell_i \tag{3.2}$$

Lemma 1 and marginal productivity condition in the competitive equilibrium implies that capital distribution should satisfy:

$$\frac{K_j}{K_i} = \left[\left(\frac{A_j}{A_i}\right) \left(\frac{\ell_j}{\ell_i}\right)^{\beta} \left(\frac{h_j}{h_i}\right)^{\gamma} \left(\frac{F_j}{F_i}\right)^{1-\lambda-\beta-\gamma} \right]^{\frac{1}{1-\lambda}} \tag{3.3}$$

for all $i, j \in N$. Plugging (3.3) into (3.2) leads to:

$$\ell_j = \left(\frac{1}{c_{ij}}\right)^{\frac{\lambda-1}{1-\lambda-\beta}} \left[\left(\frac{A_j}{A_i}\right) \left(\frac{F_j}{F_i}\right)^{1-\gamma-\lambda-\beta} \right]^{\frac{1}{1-\lambda-\beta}} \left(\frac{h_j}{h_i}\right)^{\frac{\gamma}{1-\lambda-\beta}} \ell_i. \tag{3.4}$$

In this equation, $A_i, A_j, c_{ij}, F_i, F_j$ are constants. If there is no movement of high skilled labor, then this condition says than low skilled labor stock at the equilibrium is proportional between locations. The spillover effects come from $(h_j/h_i)^{\frac{\gamma}{1-\lambda-\beta}}$. Since this is increasing in h_j, this implies that higher the high skilled labor movement to j independent of source region, higher the low skilled labor movement from i to j.

We can find a similar condition for high skilled labor movements as well: If $\theta_{ij}^{s} > 0$ then

$$h_j = \left(\frac{1}{c_{ij}}\right)^{\frac{\lambda-1}{1-\lambda-\gamma}} \left[\left(\frac{A_j}{A_i}\right) \left(\frac{F_j}{F_i}\right)^{1-\gamma-\lambda-\beta} \right]^{\frac{1}{1-\lambda-\gamma}} \left(\frac{\ell_j}{\ell_i}\right)^{\frac{\beta}{1-\lambda-\gamma}} h_i. \tag{3.5}$$

Therefore, gathering up the constant terms in equations (3.4) and (3.5) by the following

$$\Phi_{i,j} = \left[\left(\frac{A_j}{A_i}\right) \left(\frac{F_j}{F_i}\right)^{1-\gamma-\lambda-\beta} \right]^{\frac{1}{1-\lambda-\beta}},$$

enables us to present the resulting spillover effects in a closed form by rewriting equations

(3.4) and (3.5) as follows:

$$\frac{\ell_j}{\ell_i} = \Phi_{i,j} \left(\frac{1}{c_{ij}}\right)^{\frac{\lambda-1}{1-\lambda-\beta}} \left(\frac{h_j}{h_i}\right)^{\frac{\gamma}{1-\lambda-\beta}}, \text{ and } \quad \frac{h_j}{h_i} = \Phi_{i,j} \left(\frac{1}{c_{ij}}\right)^{\frac{\lambda-1}{1-\lambda-\gamma}} \left(\frac{\ell_j}{\ell_i}\right)^{\frac{\beta}{1-\lambda-\gamma}}.$$

CHAPTER 4

ALLEVIATION OF EFFICIENCY LOSSES

In our model, we assume that people migrate to places providing higher real returns for their labor. However, in order to use their human capital effectively, migrating agents should adapt to the new environment. Clearly, a migrant would be disadvantaged against the native of the same skill type, since the native is more accustomed to and knows the ways of the environment they are to work in. This is called the efficiency loss of migration. Hence, in the same skill group, immigrants earn lower wages than natives. But this wage gap decreases over time (Borjas, 1985; Chiswick, 1978). One possible explanation for this is that migrants get integrated into the labor market of the host country and as a result they start using their human capital more efficiently. Decreasing the corresponding efficiency losses, therefore, would give rise to higher return to human capital.

Language, for example, is an important barrier for migrants. In order to be efficient, communication is important factor in order to understand the task. Aydemir and Skuterud (2005) states that one third of the decrease in the migrant entry level wage can be attributed to the change in migrants national mix and language abilities. Hence, language proficiency is important for using human capital effectively.

Another human capital loss from migration might be that host country does not recognize the qualifications. If degrees, certificates earned in foreign countries are not accepted, then he simply is seen as non-graduate. So they might be recognized as low skilled workers.

In this chapter, our aim is to understand the effect of policy changes regarding the

alleviation of efficiency losses. Germany, Poland and Czech Republic provides a good thought experiment for this purposes. First of all, these three countries are in the European Union, which enable workers to freely move across borders. Therefore there is no effect of visa policies. Secondly, in 2005 Germany passed new migration law. One of the aim of this law is to fasten the integration process of migrants. In this regard, Germany offered language courses both in basic level and occupational specific, accredited foreign qualifications, and increased the services to introduce German system (Burkett & Haas, 2014).

In our simulation, we consider effect of such policy changes. We will assume that in order to attract skilled labor from Poland, somehow, Germany implements policies that decline the efficiency losses concerning the skilled labor from Poland coming to Germany. As stated above, this may involve offering occupational or technical language courses for the skilled Polish migrants. Moreover, there are no changes regarding migrants to Germany from the Czech Republic (both skilled and low skilled) and low skilled migrants from Poland. In what follows, we show that by only changing the efficiency loss parameter for skilled labor from Poland, a migration of low skilled labor from Czech Republic to Germany is triggered.

4.1. Parametrization

The parameters we should adjust for the simulation are skilled and unskilled labor force, capital stock, TFP level, elasticity of substitution and share parameter between skilled and unskilled labor, efficiency loss for both skilled type in each country.

Labor force data is taken from the World Bank and skill composition is taken from OECD (OECD, 2014). We identify skilled labor that has education at tertiary level. Germany has the highest level of skilled labor, with 28%, then Poland and Czech Republic with 25% and 19% respectively. It is assumed that total land in a given country is equal to its population, thus per capita land is one in each region. Capital stocks are taken Penn World Tables 8.1 (PWT) (Feenstra, Inklaar, & Timmer, 2015). All of these parameters are normalized to Germany, and we present the other countries values as relative to Germany.

Share parameter, α in the equation 2.1 is adjusted such that skill premium in Germany, i.e w^h_{GER}/w^ℓ_{GER} mimics the observed level in OECD report (OECD, 2014). For elasticity of substitution between skilled and unskilled workers, $1/(1-\rho)$ in the equation 2.1, we use the estimates of Borjas et al. (2012). They estimate elasticity of substitution in the US between -0.326 and -0.62 with different specification. We took $\rho = 1/3$ which corresponds to elasticity of substitution around -0.66.

For income shares, the values used by Klein and Ventura (2007) are used. So we set share of capital as $\lambda = 0.317$, share of income as $\eta = 632$. We assume that these are same across countries. Furthermore, efficiency loss for low skilled is set to 0.6 and for high skilled is set to 0.8 for all destinations. Also we assume that there is no fixed costs of moving.

The recent version of PWT gives the TFP level of countries relative to the US (Inklaar & Timmer, 2013). We use them in our analysis with slightly change in the observed values, without changing the order, in order to have more pronounced results. TFP of Germany is increased to 0.97 from 0.8286, TFP of Czech Republic increased to 0.74 from 0.5916. Poland's TFP taken as it is given by 0.8033.

4.2. Simulation

Panel A of Table 4.1 shows these parameters, and Panel B gives the equilibrium rate of returns on labor, capital and land, and gives GDP of the countries. As it can be seen Germany is the biggest economy, and both high and low skilled workers are better than other places. But, this wage difference does not compensate the efficiency losses, hence there is no migration in the initial situation.

In order to see the effect of the change in Germany's integration policy, we decrease the efficiency loss of Polish high skilled workers migrated to Germany, i.e increase c^h_{PG}. Initially, we assumed that $c^h_{PG} = 0.8$. Suppose this figure is raised to 0.95. Since there is no change for any parameter that affects Czech Republic, it would be expected that the labor should stay there. However, Table 4.2 shows that not only high skill labor from Poland is migrated, but also low skilled labor from Czech Republic migrated.

Table 4.1: Efficiency Loss - Initial Equilibrium

Panel A: Edowments of Countries

	Poland	**Czech Republic**	**Germany**
Low Skilled	0.340	0.106	0.720
High Skilled	0.113	0.025	0.280
Population	0.454	0.130	1.000
Capital Stock	0.299	0.073	0.880
Land	0.454	0.130	1.000
TFP	0.803	0.740	0.970

Panel B: Returns in the Equilibrium

	Poland	**Czech Republic**	**Germany**
Wage	0.241	0.198	0.329
Compensation	0.401	0.416	0.494
Return on Land	0.023	0.019	0.030
Return on Capital	0.214	0.214	0.214
GDP	0.202	0.049	0.594

Table 4.2: Efficiency Loss - Simulation Results

Panel A: Distribution of Factors

	Poland	**Czech Republic**	**Germany**
Low Skilled	0.340	0.100	0.724
High Skilled	0.087	0.025	0.305
Population	0.427	0.124	1.032
Capital Stock	0.274	0.070	0.907
Land	0.427	0.124	1.029
TFP	0.803	0.740	0.970

Panel B: Returns in the Equilibrium

	Poland	**Czech Republic**	**Germany**
Wage	0.228	0.201	0.335
Compensation	0.452	0.406	0.476
RentLand	0.021	0.019	0.031
RentCap	0.214	0.214	0.214
GDP	0.185	0.048	0.613

Around 6% of the low skilled labor in the Czech Republic migrates in the equilibrium thanks to newly arrived Polish high skilled migrants. 18.75% reduction in efficiency loss induce to migration of 23% the skill labor in the Poland, and 6% of low skilled labor in Czech Republic. The impact is huge. If we consider smaller decrease in efficiency loss, suppose we set $c^h_{PG} = 0.85$, then we see migration of 1.5% of low skilled labor in Czechs and 7.6% of high skilled labor of Polish.

The cause of this spillover effect can be understood from Table 4.3. Wage rate of low skilled labor in Germany increased by 2% even though there exist a low skilled migrant flow. This is due to huge expansion in human capital by taking Poland high skilled workers. Complementarity between skill groups leads to rise in wage rate, which in turn stimulate the flow of Czechs.

When we look at the impact of this migration flow on the economic outcome, in Germany, only high skilled worker is worse off: there exist a 4% cutback in skill compensation rate. However, economy produces more output, GDP grows 3.23%, though there is almost no change in per capita outcome. This is because growth in GDP is similar to expansion in population. On the other hand, as a high skilled sending country, Poland looses. Its output drops by 8.16%, and per capita impact is -2.52%. Only high skilled workers in Poland are better off, since around one fourth of them left the country, which makes high skilled worker scarcer. Similar to Poland, Czech Republic also shrinks. However, although its GDP shrunk, its GDP per capita improved around 1%. This might be because of the enlargement in the skill composition in Czech Republic, which in turn enlarges the average productivity in the country. World total output is expand by 0.11%. World as a whole gain from this policy change.

Table 4.3: Efficiency Loss - % Changes

	Poland	**Czech Republic**	**Germany**
Low Skilled	0.00%	-5.74%	0.51%
High Skilled	-23.20%	0.00%	8.93%
Capital Stock	-8.27%	-3.74%	3.12%
Population	-5.80%	-4.65%	3.24%
GDP	-8.16%	-3.64%	3.23%
GDP percap	-2.51%	1.06%	0.00%
Wage	-5.32%	1.56%	1.69%
Compensation	12.90%	-2.36%	-3.62%
Ret. Land	-8.16%	-3.10%	4.32%
Ret. Capital	0.11%	0.11%	0.11%

In the equilibrium, Germany did not gain anything in per capita term in spite of increase in skilled population in the country to more than 30%. This inverse impact is due to the indirect impact of this integration of Polish high skilled workers on the low skilled workers. At the end low skilled Czechs also migrate to Germany.

CHAPTER 5

VISA POLICIES

Visa granting policy is important in the determination of the skill composition of the migrants. Which characteristics would be favored, how many visas would be given is important decisions in this sense. By using these criteria, countries can choose the high skilled labor from the migrant applicant's pool. Also, they can provide special visa categories for particular skilled labor, such as H-1B visa of the US government issues. In the end, countries may increase the proportion of the high skilled labor migrants.

Although countries use admission criteria favoring the high skilled migrants, the outcome may not be as expected. Cobb-Clark (2000) finds that visa categories have little importance on labor force participation; however immigrants selected for their skills have higher rate of employment after a period of time in Australia. Even though Canada seems to attract more high skilled migrants than the US, some relate this to the particular national mix of the migrants. If Canada were to attract migrants from countries with higher (average) level of education, then the overall skill level of migrants would be higher. Indeed, according to Borjas (1993) and Antecol, Cobb-Clark, and Trejo (2003), Canada accepts migrants from higher educated regions, hence has more high skilled migrants due to national-mix of the migrants. In contrast, Aydemir (2011) using Oaxaca decomposition shows that for any given source country, Canada admits more high educated people than the US. Hence, either by changing the national-mix of migrants or by accepting high skilled labor rather than the low skilled one from any given country, it might be possible to enlarge the high skilled labor population.

In order to capture these policies, we implement probability of admitting to a country as migrant parameter into the model. π_{ij}^{s} gives the probability of acceptance into the region j who attempts to migrate from i in skill level s, where $i, j \in N$ and $s \in \{\ell, h\}$. We differentiate this probability across skill groups, which enable us to examine the policy effect of favoring the high skilled labor migration rather than the low skilled labor migration. If π_{ij}^{h} is higher than π_{ij}^{ℓ}, then region j is favoring high skilled labor from region i and high skilled labors have greater acceptance rate. We also allow this probability to depend on origin-destination regions, which permit us to change the nation-mix of migrants for any given region.

In this chapter, we consider the possible effect of reduction in the visa restrictions for Mexican labors. First, as a baseline, we show the results of the model for observed real data. Then, as an extreme case, the results for unrestricted migration policy for Mexicans will be considered. Later, we show the effect of partial elimination of restrictions on this labor movement.

5.1. Parametrization

We will use similar strategy with Germany example for parametrization. With the same arguments, we set elasticity of substitution between skill groups such that $\rho = 1/3$, income share of labor as $\eta = 632$ and income share of capital as $\lambda = 0.317$. In order to mimic the relative income of skilled labor to unskilled, we set α as 0.314.

Skilled labor share of the workforce of the US, Canada and Mexico are 42%, 52%, and 18% respectively (OECD, 2014). Again, land per capita assumed to be one in all countries. Capital stock is taken from PWT and turned into relative to the US (Feenstra et al., 2015).

TFP levels also taken from PWT. Corresponding figures for the US is 1, for Canada it is 0.879, and for Mexico it is 0.725. Efficiency loss for low skilled is 0.6 and it is 0.8 for high skilled labor independent of destination and origin.

In this simulation, the important parameter is π_{MU}^{ℓ}. We want to analyze the effect of low skilled Mexican migrants on the US economy. To this end, we allow to change

the migration flow from Mexico by changing π^{ℓ}_{MU}. In turn we show that low skilled labor migrant from Mexico will trigger high skill labor migration. We set $\pi^{\ell}_{MC} = 0$ and do not allow Mexicans to migrate to Canada, because of low skilled migrant would prefer to migrate to the US. If the US does not accept them, then Canada would not accept them too. All other migration flow is possible, i.e we set $\pi^{h}_{ij} = 1$ for all $i, j \in \{M, C, U\}$ and $\pi^{\ell}_{\{}ij\} = 1$ for $i \in \{C, U\}$ and $j \in \{M, C, U\}$

When we impose these parameters to the model, Canadian high skilled workers want to migrate to the US. In order make the initial condition as equilibrium, fixed cost of moving from Canada to the US is set as slightly higher than wage rate difference between the native high skilled workers in Canada and Canadian high skilled workers in the US: $M^{h}_{CU} = (1 + \chi/100) w^{h}_{U} * C^{h}_{CU} - w^{h}_{C}$, where χ gives the percentage excess of fixed cost from wage difference. We will take χ as 1 and 5 in our analyzes.

5.2. Simulation

As it is seen from the Table 5.1, there exists a huge income difference between Mexico and the US for low skilled labor. This is because we do not allow them to move; hence it is not equalized at the equilibrium. Moreover, even though compensation in the US is higher than Canada, fixed cost comes into the play and Canadian high skilled worker does not migrate.

In the first exercise, we consider the situation where there is no restriction on migration. On the left side of the Table 5.2 fixed cost adjusted as one percent above of the wage gap. On the right side of the table, it is adjusted as five percent above the wage gap. Small amount of change in fixed cost has small impact on outcome. Left panel and the right panel are very similar. However, there is important difference between the tables: no restriction case and initial condition.

When the restrictions on Mexicans are diminished and sufficient number of low skilled Mexicans migrated to the US, Canadians also migrate to the US. Since they are compliment, low skilled labor from Mexico increases the compensation rate in the US, and Canadians are now can afford the fixed cost. Even with the high skilled migration,

Table 5.1: Visa Policy - Initial Equilibrium

Panel A: Edowments of Countries

	Canada	**Mexico**	**the US**
Low Skilled	0.06	0.27	0.58
High Skilled	0.06	0.06	0.42
Population	0.12	0.33	1
Capital Stock	0.10	0.14	0.94
Land	0.12	0.33	1.00
TFP	0.88	0.73	1.00

Panel B: Returns in the Equilibrium

	Canada	**Mexico**	**the US**
Wage	0.22	0.09	0.22
Compensation	0.46	0.53	0.60
RentLand	0.03	0.01	0.03
RentCap	0.20	0.20	0.20
GDP	0.07	0.09	0.61

Table 5.2: Visa Policy - No Restriction on Labor

	$\chi = 1\%$			$\chi = 5\%$		
	Canada	**Mexico**	**the US**	**Canada**	**Mexico**	**US**
Low Skilled	0.0589	0.0463	0.7152	0.0589	0.0463	0.7152
High Skilled	0.0591	0.0192	0.4562	0.0596	0.0192	0.4558
Population	0.1072	0.0655	1.2814	0.1185	0.0654	1.2701
Capital Stock	0.0975	0.0372	1.0491	0.0980	0.0371	1.0485
Land	0.1228	0.3313	1.0000	0.1228	0.3313	1.0000
TFP	0.8785	0.7253	1.0000	0.8785	0.7253	1.0000

	$\chi = 1\%$			$\chi = 5\%$		
	Canada	**Mexico**	**the US**	**Canada**	**Mexico**	**the US**
Wage	0.2125	0.1250	0.2083	0.2132	0.1250	0.2083
Compensation	0.4632	0.4914	0.6143	0.4622	0.4915	0.6144
RentLand	0.0262	0.0037	0.0346	0.0264	0.0037	0.0346
RentCap	0.2052	0.2052	0.2052	0.2052	0.2052	0.2052
GDP	0.0631	0.0241	0.6867	0.0635	0.0240	0.6788

which put downward pressure on the compensation rates, the rise in the compensation rate is around 1.6%.

We see a significant increase in the wage rate of low skilled workers in the Mexico. This is because the drastic shrink in the low skilled labor force there. More than 80% of the low skilled labor in Mexico migrates to the US. Moreover, this flow cause to decline in the wage of high skilled workers in Mexico; hence they also migrate in this scenario. Even though the restriction in the first place does not bind them, we only see this flow after elimination of barriers for low skilled labor. Together with these two flow of Mexicans, this figure means that today 80% of the Mexicans wants to move to the US.

Table 5.3: Visa Policy - % Changes

	$\chi = 1\%$			$\chi = 5\%$		
	Canada	**Mexico**	**the US**	**Canada**	**Mexico**	**the US**
Low Skilled	0.00%	-82.97%	23.32%	0.00%	-82.97%	23.31%
High Skilled	-7.42%	-67.86%	8.61%	-6.65%	-67.88%	8.52%
Population	-3.86%	-80.25%	27.06%	-5.34%	-72.75%	11.09%
Capital Stock	-5.84%	-72.74%	11.14%	-3.46%	-80.25%	27.01%
GDP	-5.13%	-72.53%	13.24%	-4.62%	-72.54%	11.93%
GDP per cap	-1.32%	39.06%	-10.88%	-1.21%	39.03%	-11.88%
Wage	-3.43%	42.20%	-6.63%	-3.10%	42.16%	-6.66%
Compensation	1.66%	-6.88%	1.62%	1.44%	-6.86%	1.65%
Ret. Land	-5.13%	-72.53%	11.98%	-4.62%	-72.54%	11.93%
Ret. Cap	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%

Canada, on the other hand, is negatively effected from this removal of barriers. Only positive figure for Canada is the compensation rate, due to reduction in the supply of high skilled worker. But this has negative effect on economy with 5% shrink in GDP and 1.3$ contraction in per capita term.

Although GDP of the US increased by 12%, 23% expansion in low skilled labor force and 11% growth in total population, lead to decrease in per capita GDP. Even though there is a 8% augmentation in high skill work force, they come with efficiency loss, hence overall efficiency drastically declined.

One interesting question regarding this picture is that, whether there is an optimum restriction on Mexican low skilled movement that maximizes the welfare of the US citizens. Since low skilled labor migration also induce to flow of Canadian high skilled worker to the US, without harming the natives, is it possible to expand the output in the economy? In order to answer this question, we gradually broaden the allowance rate of

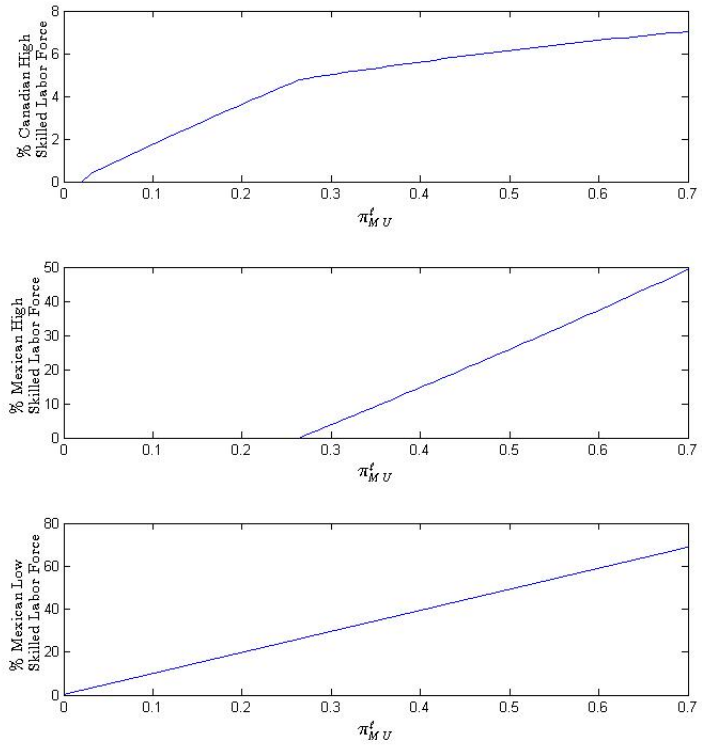

Figure 5.1: Movement to the US

Mexicans. For different values of π^{ℓ}_{MU}, we compute the general equilibrium and look at the welfare in the US.

Figure 5.1 shows the percentage of the labor force in the source country that migrates to the US for different level of π^{ℓ}_{MU}. In the first panel, it is seen that after around 3% of the low skilled labor from Mexico migrated, Canadian high skilled workers also starts to migrate. When Mexico loses twenty seven percent of its low skilled labor, high skill Mexicans also migrates to the US. This addition flow of high skilled worker decreases the rate of increase in the Canadian high skill labor flow.

Capital moves parallel to labor. Since capital and labor is complementary, increase in human capital boosts the return on physical capital, hence people invest more in the US when the labor force there enlarged. As it seen in the Figure 5.2, both capital stock and return on capital rise. Furthermore, return on land also improves, since it is also complementary to labor. So, capital owners in might want to reduce the restriction on the labor movement.

Gradual expansion in labor force contribute to expansion in output. This is not

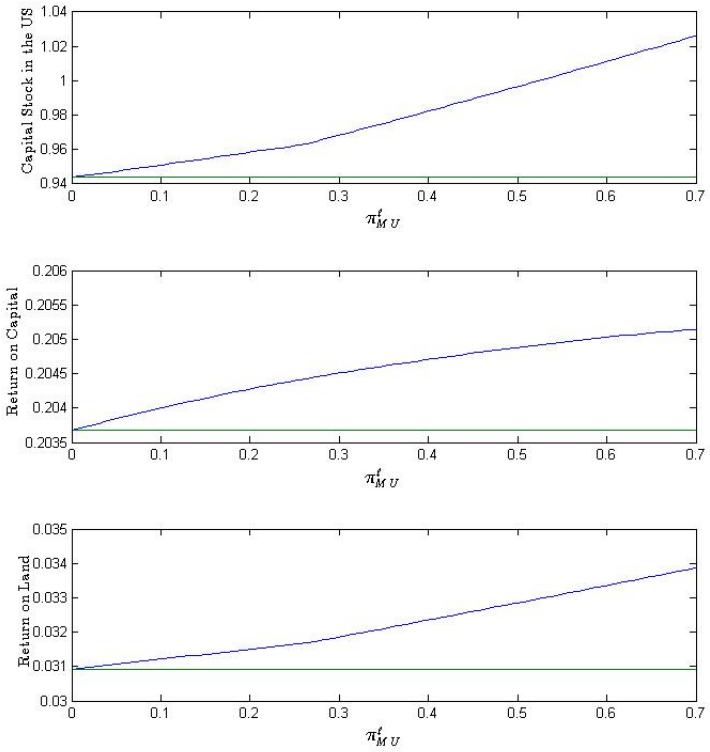

Figure 5.2: Asset Returns

surprising since more input is used in the economy. However, per capita output depressed with the higher low skill labor movement. This is because population increases higher than the labor efficiency.

Since the low skilled labor enlarged with the removal of restrictions, wage rate for them also cutback. On the other hand, the high skill labor in the US gains from this movement. But the increase in their gain diminishes with the flow of Mexican high skilled labor. Although there exist a decline in wage rates, rise in the return on capital and land might eliminate this loss. However, Figure 5.5 shows that this is not the case. Total welfare of the low skilled labor is strictly decreasing with the greater low skilled labor movement.

To sum up, even with a slight elimination of restriction on low skilled labor from Mexico triggers the movement of Canadian high skilled worker. The benefit for high skilled is increasing with this flows, but low skilled labor in the US is losing.

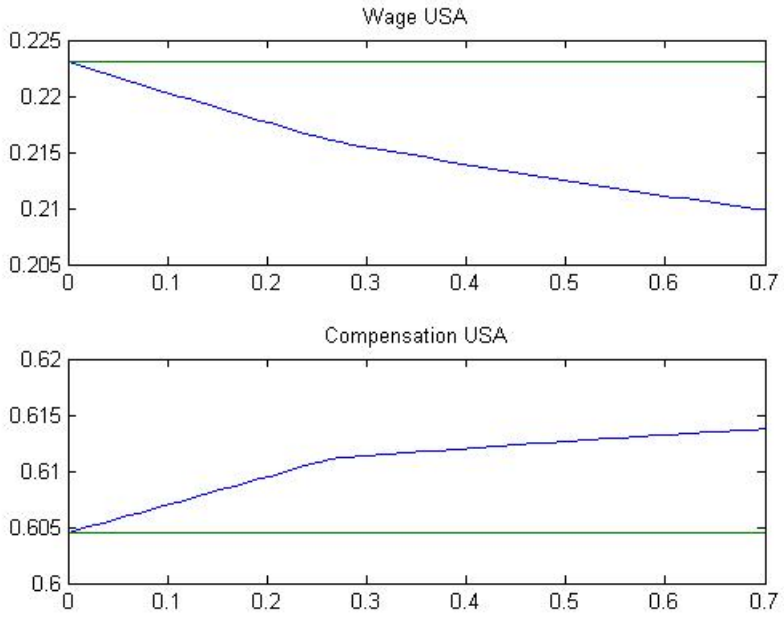

Figure 5.3: Return on Labor

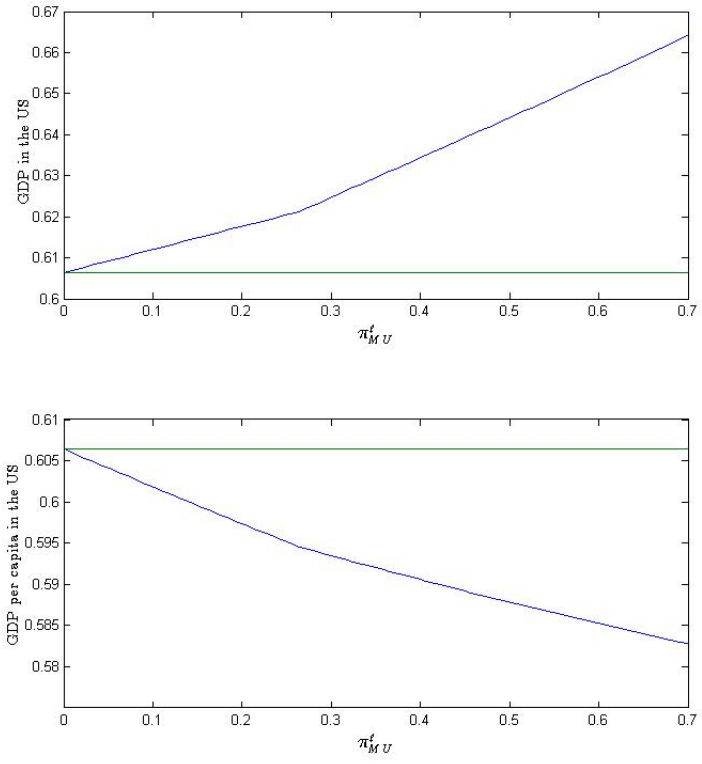

Figure 5.4: Output

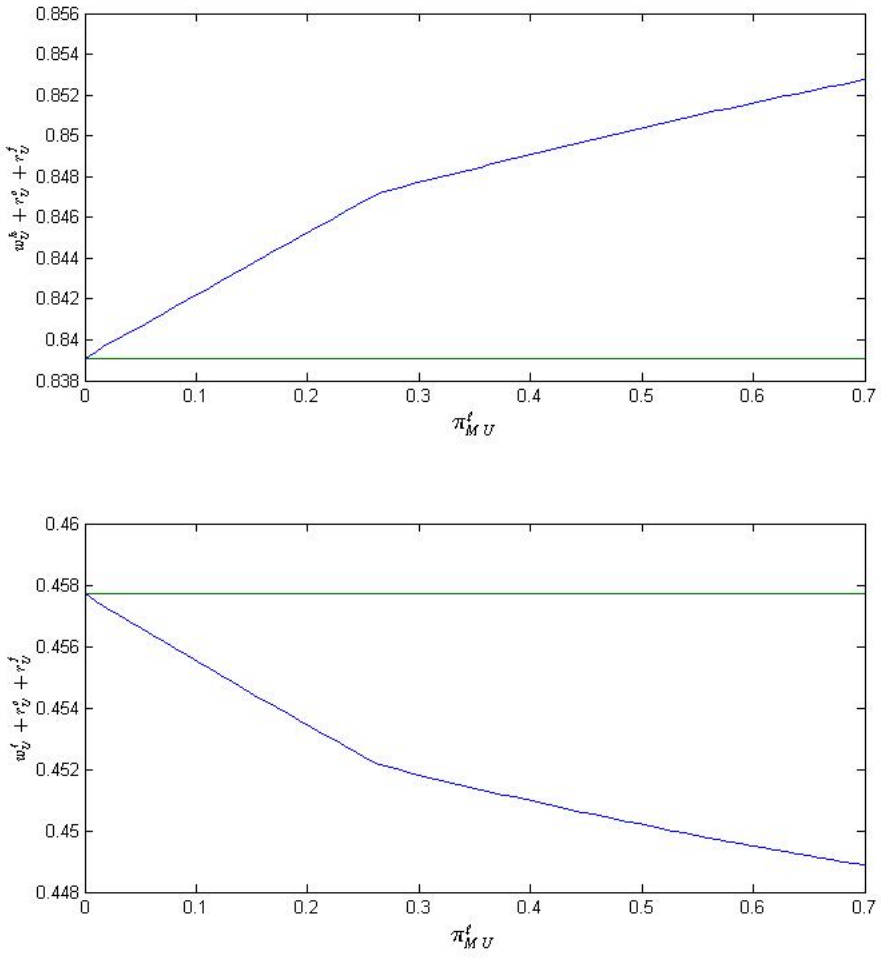

Figure 5.5: Total Return

CHAPTER 6

CONCLUDING REMARKS

The migration is an important topic in politics. While low skill migrants seems to burden on native population, high skilled workers are important for the future prospects of the country. Therefore, countries want to attract the brightest and most talented people around the world.

However, the flow of one skilled group has a spillover impact on the other skilled group's migration. In this theses, we showed this observation holds in a general equilibrium model, with free capital movement and restricted labor movements. Indeed, changes in policy related parameters in order to attract high skilled worker leads to increases in low skilled labor migration, and vice-a-versa.

Providing language courses, giving better services to high skilled migrants are policies used in Germany in order to attract high skilled worker. This way migrants would integrate to the labor market and the efficiency loss would lessen. This would augment the return on migration, hence Germany would become a desired destination for skilled labor. Though, this would stimulate the low skill labor flow since high skills increase the wage rate for them. Even at the beginning the aim was to capture the high skilled labor, at the end we end up with low skilled labor movement.

Changing the restrictions on the low skilled labor migration, on the other hand, might increase the flow of high skilled labor. Because more low skilled labor cause increase in compensation, with the flow of low skilled migration, educated labor also wants to migrate.

Our model assumes full employment, therefore we do not consider the migrants effect on unemployment level. Also, we did not model illegal migration. However, illegal migration is major problem between the US and Mexico. These two features might affect the outcome of the model negatively.

In contrast, changing these parameters are costly. In order to increase the integration processes, countries need to hire more people and spend more on services. Thus, fastening the integration process is also burden on tax payers. On the other hand, elimination of restrictions on labor movement has positive effect on government budget, since visa granting process and border protection is costly. As a future research, the optimum level of such policies, considering their costs, can be analyzed.

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