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Abstract

This note derives positive implications about the effect of immigration on labor income and the skill composition of the labor force in receiving economies. The novel mechanism through which immigration affects labor-market outcomes is the availability of new loanable funds for human-capital investment, which results in endogenous skill upgrading. Given their higher training costs in the host economy, immigrants usually do not acquire advanced academic skills, and they accordingly skip the financial costs of education at the college level. As a result, they self-select as net lenders, which reduces the equilibrium interest rates and facilitates the upgrading mostly of new generations of natives. Consequently, the aggregate labor income of natives increases with immigration.

1 Introduction

Both legal and illegal immigration from LDCs conform a reality acquiring unprecedented dimensions today in many developed countries. Accordingly, there has been a substantial deal of controversy as to whether the average native worker gains or loses from the new migratory flows. Two recent empirical exercises that obtain quite

opposite conclusions are Borjas (2003) and Ottaviano and Peri (2006). The main reason why the second of these papers estimates a net average gain, unlike the first one, is the multiplicity of channels by which immigrants affect labor market outcomes. Apart from the downward pressure on native wages, Ottaviano and Peri's structural model allows for a consideration of between-worker complementarity and the entry of new firms in response to higher profitability.

Our purpose in this paper is exploring an alternative channel by which the immigration surplus could be enlarged. Unskilled immigrants are often accused of draining funds from the welfare systems of recipient countries, while they contribute very little with direct taxes given their low upgrading prospects. Here we explore a novel mechanism by which they could offset - at least partially - that effect as net suppliers of loanable funds. We show how immigrants - even when they are permanent - face cultural barriers that increase their training costs; this fact makes them work during most of their life-cycle, without a formal acquisition of academic training at the college level. Moreover, after skipping these academic financial costs, an altruistic motive leads them to carry their savings forward into the future in order to bequeath to their children, which raises the amount of loanable funds available in the financial system. This increase in loanable funds lowers interest rates, thus providing young cohorts of natives with savings to finance their educational expenses. These favorable financial conditions lower the ability requirement for those who try to become skilled, who are mostly native, which raises the skill composition in the host economy.

In order to make our results as sharp as possible, we explore the limit case in which the (labor-market) complementarity between skilled and unskilled labor is totally switched off. In spite of that, we find that an immigration surplus continues to exist, even if both labor categories are perfectly substitutable. Therefore, although wages hardly vary with immigration, the skill-upgrading of natives leads to an immigration surplus. This result runs counter to Borjas (1994)'s statement that 'an immigration

surplus arises *only when native wages fall* as a result of immigration'.

We want to emphasize that - given their higher training costs and the intergenerational persistence of that situation - certain ethnic groups of immigrants are likely to remain stuck in their relative position of inferiority with respect to earnings and upgrading. However, *precisely because of that stickiness* - and since they will probably work during most of their life cycle - they can provide natives with better wage prospects, even in the absence of wage-premium rises due to skill complementarities. Therefore, the frequent complaint about the relatively poor performance of some immigrants in the labor market may not always be justified, since the main reason for their relative economic backwardness - i.e. their higher training costs - is also the key to some natives' gain from immigration.

2 Related Literature

2.1 Theoretical Contributions

There is a long history of attempts to account for the dynamics of the economic performance of immigrants relative to natives. Along the whole series of theoretical and empirical efforts to understand the issue, there has been a common interest in the savings rate, frequently considered the key to migrants' capacity to accumulate wealth and increasingly approach the economic performance of the native-born. Initially, migrants' apparent success to approach - and even eventually outperform - their native counterparts was justified with self-selection arguments: the migratory decision was only undertaken by a very specific range of the foreign-born population, and therefore the human-capital and demographic characteristics of migrants and natives were not homogeneous.

However, in the late 80's Djajic (1989) and Galor and Stark (1990) inaugurated

a line of research by which *incentives in the host country* - as opposed to a self-selection derived from the migratory decision - were highlighted as the reason for the higher local saving-rates of immigrants relative to otherwise identical natives. The differential incentives faced by migrants came for a certain probability of return migration: they saved more than natives because lower future wages in the home country increased their future marginal utility of wealth, and the extra precautionary savings were useful for them to outperform comparable native-born.

The main novelty of our approach is that *it applies even to permanent residents* in the host country who will never intend to return. That is, a higher savings propensity does not need to hinge on a probability of return migration and an earnings differential between the home and the host country. In this sense, Cornelius (1990) reports that the maturation of social networks of unskilled migrants in the US is making of permanent migration a prevalent phenomenon: " the shift from a migrant population consisting mainly of highly-mobile, seasonally employed 'lone males', towards a more socially heterogeneous, year-round, *de facto permanent* Mexican immigrant population in California accelerated in the 1980's". This tendency adds some relevance to the potential channel we identify.

2.2 Empirical Evidence

Concerning the empirical literature, a few old pieces of evidence seemed to capture the regularities we mentioned above about migrants' savings propensity. For example, Jones and Smith (1970) reported that the *local* (i.e. net of remittances) savings rate of migrant workers in Great Britain in 1975 was about 2% above the UK average. For France, the average local savings of foreign workers in 1970 was 50% higher than those of a French person with the same income (Granier and Marciano (1975)). Further evidence from this period is also collected in MacMillen (1982).

Nevertheless, the previous articles provide only a weak support to our argument, since they are based on data from countries where higher education is heavily subsidized by the public sector, and therefore where our basic mechanism can hardly hold. That is the reason why we have turned to the evidence from the US, where it is a common practice to apply for loans to finance educational expenses and repay those loans once the applicant owns a steady job. Our major relevant findings about the US reality can be summarized as follows:

- a) According to the 2001-2002 Current Population Survey (CPS), the workforce participation by male undocumented migrants reaches 96%, whereas only 84% of comparable native-born US citizens are members of the labor force.

- b) Immigrants conform 11% of total US population, 14% of all workers, 20% of low-wage workers and 39% of low-skilled workers. These numbers seem to roughly validate our assumption about higher training costs for migrants, and to confirm our outcome about their self-selection as low-skilled workers.

- c) Is there any evidence in support of their crucial role as net lenders in the US? Concerning this issue, we have resorted to the econometric results obtained by Carroll, Rhee and Rhee (1999). These authors use household data from the 1980 and 1990 Census of Population and Housing in the US to test whether the saving patterns of immigrants are significantly different across the country of origin, and also whether those patterns match up with the saving patterns of their home countries. They also test whether there is a general "immigration effect" at the time of entry, taken to mean the effect on saving that is common to all immigrants, regardless of their origin and the duration of their stay in the US.

Interestingly, they find that *"all immigrants have higher saving rates than natives"*, and the "immigration effect" on the savings rate is positive and significant. But that is not the end of the story: if their basic motivation to save so much was a possibility

of return migration - as in Galor and Stark (1990) or Stark (2006)'s models - they should have found that assimilation completely eliminates the extra savings. *But, however, for many countries the estimates show no sign of assimilation in savings behavior.* Even for those countries which have those signs of assimilation, "it takes 27 to 62 years to close a 5 percent saving rate gap".

Moreover, Carroll, Rhee and Rhee (1999) also report that "immigrants from Greece, Italy and Portugal had the highest savings rate, over twenty percent of income annually." And, precisely, it is noticeable that people from those countries in the sample are mostly blue-collar workers (producers and labor workers) often with only elementary educational attainment (47.5% for Greece, 67% for Italy and 74.6% for Portugal, respectively). We believe that there must be an underlying economic rationale behind the saving behavior of those ethnic groups and its impact on the host economy, and we have tried to shed some light on these issues.

3 The Model

3.1 Assumptions and general description

Immigrants are assumed to stay permanently in the host economy. They enter the host country (at the beginning of their life) without previously-accumulated human capital, and - for simplicity - the higher training costs are intergenerationally permanent, in such a way that there is no difference between newly-arrived immigrants and their children with respect to upgrading probabilities.[1]

We portray a receiving country whose production function combines skilled (N_s)

[1] Alternatively, we could make every generation of immigrants become identical to natives in their second period of life, but allow for a continuous flow of immigrants in every period. Under this alternative setup, we would not expect results to change substantially.

and unskilled industrial workers (N_u) in a perfectly-competitive environment. For simplicity, we have abstracted from the use of physical capital. Individuals supply a unit of labor inelastically and there is no disutility from effort. The production function faced by any productive unit is specified as follows:

$$y = (N_u^{\varepsilon} + \delta N_s^{\varepsilon})^{\frac{1}{\varepsilon}} \tag{1}$$

where $\delta > 1$ is an indicator of technology bias towards skilled labor. Traditional models of immigration surplus have focused on labor-market complementarities derived from a limited degree of substitutability between skilled and unskilled labor ($0 < \varepsilon < 1$); this resulted in a net gain for the native population once unskilled wages fell and the subsequent surplus was appropriated by skilled labor (or capital). In contrast to these explanations - and in order to sharpen our point - here we will focus on a pure capital-market complementarity in which both types of labor are perfect substitutes and - consequently - their respective wages are not altered by immigration (since $\varepsilon = 1$). We will show how, even in that case, skill-upgrading is able to induce a rise in the aggregate labor income of natives.

As a result of perfect competition - and given (1) and our assumption on perfect substitutability ($\varepsilon = 1$) - the skill-premium is given by

$$\omega = \frac{w_s}{w_u} = \delta \tag{2}$$

In our model, which is based on Galor and Zeira (1993), individuals live for two periods. In the first one they must decide whether to acquire skills by investing in academic training - using the parental human-capital bequest - or to work as unskilled; in the second period they work according to their skills, consume, have a child, decide upon the child's home education and (potentially) leave a human-capital bequest.

Our particular assumption is that parents do not bequeath physical or financial capital in period two, but they can hire some qualified professors to teach their child at home and reduce his/her future training costs (at the university) in case he/she

was to become skilled.[2] More specifically, if the child is capable enough, parents finance x hours of home teaching. Such a human-capital transfer will reduce their child's needed number of hours in college by the amount ax, where a is a measure of the idiosyncratic ability of the child to profit from home-education.

We adopt the assumption of risk-neutrality of preferences and warm-glow altruism, in the form of parental interest in the future income enjoyed by the child. The assumption on risk neutrality is a strong one, because in that way the optimal human-capital bequest (x) is independent of parental wealth. Nevertheless, we are not interested in the dynamics of income inequality, but in a simple comparative-statics exercise between two steady states with a different proportion of migrants in the population of the host country. Under risk neutrality, there will be a unique steady state, which will facilitate our work. Let us consider the following utility function, expressed in expected terms:

$$U_t = c_t + \beta E_t W_{t+1} \tag{3}$$

where c_t stands for consumption (during adulthood) and $E_t W_{t+1}$ for the expected income accruing to the next generation. On the other hand, β is an indicator of parental altruism towards future generations.

During his/her educational process, any individual must hire a quantity γ of skilled professors at the university, though his own ability combined with the human capital bequest allows him to reduce that upgrading cost. Every professor works for one period. When deciding whether to upgrade skills in period one or not, young individuals make the following comparison:

$$(2 + r) \gtrless \delta(1 - (\gamma - ax)(1 + r)) \tag{4}$$

[2] Altruism and bequests are not strictly necessary to make our point. Nevertheless, they are convenient to justify immigrants' decision not only to work from the beginning, but also to postpone consumption and save. An alternative would be introducing a reason to save endogenously during the first period of life, by means - for example - of a cost of rearing children during the second period.

where $\gamma\delta$ is a measure of the training costs, which depend on the skilled wage - as in Rigolini (2004) - because only skilled teachers can train the unskilled labor force.The term ax represents the amount of training that the individual can skip due to the familial transmission of human capital (x) and his/her idiosyncratic ability (a).

Unskilled individuals are supposed to work in both periods and save the initial earnings for the second one, since they only consume (and bequeath) in period two. *The skilled ones borrow from the unskilled to pay for their training costs* in the first period, and then repay their debt once they receive the skilled wage in the second period. Consequently, from (4), a young native individual will decide to upgrade skills iff

$$a \geqslant \frac{1}{x}\left(\gamma + \left(\frac{(2+r)-\delta}{\delta\,(1+r)}\right)\right) \equiv \bar{a} \tag{5}$$

whereas a similar expression $\bar{a}'$ holds for immigrants provided that we replace γ by $\gamma' \geq \gamma$.

Our assumption is that parents observe the realization of the child's ability and decide upon leaving a human-capital bequest (or not) on the basis of that realization. From (5), they know that the child will upgrade iff $x \geq \frac{\phi}{a}$, where

$$\phi(r) = \gamma + \left(\frac{(2+r)-\delta}{\delta\,(1+r)}\right) \tag{6}$$

and a is the observed realization of the ability random variable. Therefore, following (3), parents will compare the current costs and future benefits of providing a bequest, which are shown in the following inequality:

$$-\delta\frac{\phi}{a} + \beta\,(\delta - (2+r)) \gtrless 0$$

For simplicity, we have assumed that parents derive utility from their child's *gross* earnings, before their debts have been repaid. This implies that parents will bequeath exactly what their child needs to become a skilled worker, and never more. If the

previous inequality is non-negative, it will be worth for them to leave a bequest due the high gross earnings of the offspring. This will happen only if the ability realization is high enough, i.e. there will be a bequest provided that

$$a \geq \alpha \equiv \frac{2 + r - \delta(1 - \gamma(1 + r))}{\beta\left(\delta - (2 + r)\right)(1 + r)} \tag{7}$$

Therefore, it is the boundary-value for the parent (α) the only relevant cutoff for the decision-making. It is easy to check that $\frac{\partial \alpha}{\partial r} > \mathbf{0}$. Let us denote by α' the relevant cutoff value for immigrants, who only differ from natives because $\gamma' > \gamma$. We also assume that a is a random variable that follows a general distribution function $F(a)$, with support on $a \in [0, \infty)$, such that $F'(a) \geq 0 \ \forall a$.

The labor force in the model can be native or immigrant. We assume that the amount of native population is normalized to 1, whereas a measure M of immigrants are already in the economy during the first period considered. The only distinction between any native and immigrant employee is the cost parameter $\gamma' > \boldsymbol{\gamma}$, which is higher for immigrants because of the need to learn the language and similar cultural barriers.

Where do teachers come from in this economy? Since they are skilled employees, they must get the same wage as the skilled industrial workers, i.e. all members of the skilled labor force must be indifferent between teaching or working for the industry. Furthermore, there must be exactly the right amount of teachers to train next period's labor force. Therefore, if we denote the measure of teachers at time t by τ_t and the measure of skilled industrial workers at time t by N_t^s, then $\tau_t = \gamma(N_{t+1}^s + \tau_{t+1})$.Hence, in steady state,

$$N^s = (1 - \gamma)\left(N^s + \tau\right)$$

3.2 Existence and uniqueness of a steady-state competitive equilibrium

If we now consider an endogenous interest rate r, we can obtain the conditions required for the existence and uniqueness of a steady-state competitive equilibrium in this economy. This equilibrium can be defined as a positive interest rate and a subsequent allocation of immigrants and natives across the skilled and unskilled occupations, such that the supply of credit by the unskilled is identical to the demand by skilled industrial workers and teachers. It is straightforward to derive that the relevant equilibrium condition in steady state is

$$F(\alpha) + MF(\alpha') = \delta\left[(\gamma - \phi)\,1 - F(\alpha)) + M\left(\gamma' - \phi'\right)(1 - F(\alpha'))\right] \tag{8}$$

where on the left-hand side we have the supply of loanable funds by the unskilled, and on the right-hand side we can observe the aggregate expenditure on training. Taking expressions (6) and (8) into account, the previous expression boils down to the following equality:

$$\frac{\delta - (2 + r)}{1 + r}\left(1 - F(\alpha) + M(1 - F(\alpha'))\right) = F(\alpha) + MF(\alpha') \tag{9}$$

Studying carefully the previous equality gives rise to the following proposition on the conditions for the existence and uniqueness of a steady-state competitive equilibrium.

Proposition 1 *If $\delta(1 - \gamma') \geq 2$, then there exists a unique steady-state competitive equilibrium characterized by a positive interest rate $r^* \in (0, \delta - 2)$, with positive measures of the native and immigrant population both in the borrowing and the lending side of the credit market.*

Proof. *From expression (9) it is straightforward, after rearranging, to come up with the following equation of the aggregate excess demand for credit:*

$$Z(r) = \frac{1}{1 + r}\left[(\delta - (2 + r))\,(1 + M) - (\delta - 1)\,(F(\alpha) + MF(\alpha'))\right] \tag{10}$$

where we have denoted by $Z(r)$ the difference between the aggregate demand and the aggregate supply of credit. From (7) we can observe that the value of r that makes $\alpha' = 0$ is

$$\underline{r} = \frac{\delta - 2 - \delta\gamma'}{1 + \delta\gamma'} \tag{11}$$

i.e. $\underline{r}$ is the value of the interest rate that shuts down the supply of credit. On the other hand, the value of r that shuts down the demand for credit is precisely

$$\bar{r} = \delta - 2 \tag{12}$$

Now we have to prove that our equilibrium interest rate lies between both values and is also unique. It is easy to show that $Z(\underline{r}) = \frac{\delta(\delta-1)\gamma'}{1+\delta\gamma'} > 0$ and also $Z(\bar{r}) = -(\delta - 1)(1 + M) < 0$. Moreover, a thorough inspection reveals that $Z(r)$ is a continuous, differentiable, strictly decreasing function for all values of r. This implies, using Bolzano's theorem, that - if $\underline{r} \geq 0$, i.e. if $\delta(1 - \gamma') \geq 2$ - then there exists a unique competitive equilibrium interest rate $r^* \in (0, \delta - 2)$ such that $Z(r^*) = 0$. Furthermore, $\alpha(r^*) > \alpha'(r^*) > 0$, which involves that there are positive measures of the native and immigrant population on both sides of the credit market. ■

The previous proposition spells out the requirement of a relatively advantageous skilled occupation (in terms of both the skill premium and training costs) for the existence of an active demand side of the credit market. At the same time, that condition guarantees that the supply side will be active as well, since market clearing ensures that one side of the market will not shut down while the other is active. Furthermore, the equilibrium interest rate is shown to be unique, which facilitates our task of predicting the effects of immigration.

3.3 The availability of loanable funds

Now we are ready to derive our desired *effect of immigration on the availability of loanable funds.* This happens because, in this setting, loans are supplied by unskilled

workers who receive income from their first period of life - though they can not consume until the second period - and they are demanded by the skilled labor force to finance their individual training expenses. Migration provides a higher proportion of unskilled people who supply funds, which reduces r and also the cutoff values of α and α' needed to access high-wage jobs. For the new supply of immigrants to provide a net supply of funds, they need to face higher training costs in order to enlarge the pool of lenders more than the pool of borrowers. As a result, it is possible to obtain an immigration surplus that does not depend on variations in the wage premium.

Proposition 2 *Provided that ε is close enough to 1 (perfect substitutability between unskilled and skilled labor) and $\gamma' > \gamma$, then $\frac{d\alpha}{dM} < 0, \frac{d\alpha'}{dM} < 0$, $\frac{dr}{dM} < 0$ and the aggregate labor income of natives increases with immigration.*[3]

Proof. *From (9) we can differentiate and solve for $\frac{dr}{dM}$ to obtain that*

$$\frac{dr}{dM} = \frac{(\delta - (2+r)) - (\delta - 1) F(\alpha')}{\left[MF'(\alpha')\frac{d\alpha'}{dr} + F'(\alpha)\frac{d\alpha}{dr} + (1+M)\right]} \tag{13}$$

Furthermore, we know from (9) that $\delta - (2+r) = \frac{(\delta-1)(F(\alpha')M+F(\alpha))}{1+M}$. By plugging the latter expression into (13), we finally get

$$\frac{dr}{dM} = \frac{(\delta - 1)\left(F(\alpha) - F(\alpha')\right)}{(1+M)\left[MF'(\alpha')\frac{d\alpha'}{dr} + F'(\alpha)\frac{d\alpha}{dr} + (1+M)\right]} \tag{14}$$

We know from (7) that $\frac{d\alpha}{dr}, \frac{d\alpha'}{dr} > 0$ and hence the denominator of the last expression is positive. For (14) to be negative we also need the numerator to be smaller than zero, which requires $\alpha' > \alpha$. This last inequality holds iff

$$\gamma' > \gamma$$

Then, $\frac{d\alpha}{dM} = \frac{d\alpha}{dr}\frac{dr}{dM} < 0$. Since wages are invariant - by perfect substitutability - and $\delta > (2+r) > 1$, the aggregate labor income of natives increases. ■

[3] By aggregate labor income of natives we understand the sum of the remunerations to both skilled and unskilled labor.

Additionally, we can make some inferences about the welfare implications of immigration for different goups of natives. All generations of natives can be ex-ante better-off if the skill premium is high enough. Indeed, we know that

$$\beta E_t W_{t+1} = \beta \left[(1 - F(\alpha))\delta + (2 + r)F(\alpha) \right] = \beta \left[\delta - F(\alpha) \left(\delta - (2 + r) \right) \right]$$

Since immigration reduces the interest rate, there are 2 opposite effects of immigration on the expected income of the offspring: on the one hand, it is easier for them to upgrade and get the higher wage, but if they do not, they will receive lower interest-rate payments. After some algebra, it is possible to come up with a neat conclusion about $\frac{dE_t W_{t+1}}{dM}$:

$$\frac{dE_t W_{t+1}}{dM} > 0 \text{ iff } (\delta - 1) \frac{d\alpha}{dr} F'(\alpha) \left(\text{share}_u \right) > 1 \tag{15}$$

where $\text{share}_u = \frac{F(\alpha')M + F(\alpha)}{1+M}$ is the share of unskilled population over the total. Expression (15) means that the expected income of the offspring will rise if (and only if) the ability cutoff is substantially lowered, many people take advantage of it and the skill premium is substantial enough.

4 Conclusions

This note establishes a formal link between the relative training costs of migrants and their working and saving behavior, with an immediate implication with respect to the skills of natives' future generations. One of the innovative aspects of this work is the absence of any reference to return migration as a key to understanding the saving behavior of immigrants. Another one is the way we disregard any complementarity between productive factors, in order to differentiate our argument from traditional models of immigration surplus.

As a conclusion, we can emphasize that the reason for the usual complaint about the relatively poor performance of immigrants in the labor market may work as a

blessing under the right circumstances, since the cause of their (relative) economic backwardness - i.e. their higher training costs - is also the key to some natives' gain from immigration. Another intriguing implication is the fact that, even in the case of perfect substitutability between skilled and unskilled labor, natives can always be better-off in real terms provided that the skill premium is high enough.