Skilled Migration and Economic Performances: evidence from OECD countries

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Skilled Migration and Economic Performances: evidence from OECD countries

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Abstract

This paper investigates the effects of immigration flows and their skill content on per capita GDP in 24 OECD host countries. Theoretical models concludes that the effect of immigrants in host country's income depends on the capital content of migrants (Benhabib 1996); empirically the question is still open and this paper contributes to make light on this. So we propose an empirical estimation on the effects of immigrants and their skill level on per capita GDP. Using a IV model to solve the endogeneity problem we found that high skilled migration has a positive effect on per capita GDP, but it is not enough to fully compensate the overall negative effects of migration on per capita GDP.

Keywords: International migration, economic performances, factor mobility.

JEL Classification: F22, F12.

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1 Introduction

This paper is an empirical investigation of the impact of immigration flows on host country's income. Looking at the simple correlation between immigration flows and per capita GDP in host countries, we notice a strong positive relation between them, but it is not easy to identify the direction of causality. In this paper by using instrumental variable estimation we are able to determine the effects of immigration flows and their skill level on host country's economic performaces in terms of per capita GDP. If a positive effects of skilled immigrants may be found, interesting policy implication on skill selective policies can be drawn.

Growing international labor migration suggests the importance of this topic in international economics: the percentage of foreign-born population over total population residing (legally) in the USA has increased by 3.6% from 1995 to 2005, and the percentage of foreign-born over USA total population in 2005 was more than 15%[1]. In Europe the stock of international migrants as a share of population was 8.8% in 2005 and it is expected to became 9.5% in 2010. Thus migration has, potentially, a crucial role for the comprehension of future economic development: how does immigration affect per capita GDP in the host countries? Do tertiary educated immigrants affects positively per capita GDP in host countries? These are the main questions that the paper wants to investigate. The debate on the effects of immigration on developed countries is wide and it concerns a lot of social disciplines, among them economics has the role to investigate the economic related effects of immigration. The motivation of this paper relies on a lack in literature, while the effects on per capita GDP of both international flows of capital (Borenztein, De Gregorio and Lee 1998; Zhang 2001) and trade (Michaely 1977; Frankel and Romer 1999) has been widely treated in literature, the effect of international flows of workers on per capita GDP has been scarcely analysed in literature. Up to now economists focused a lot, both theoretically and empirically, on the labor markets effects of immigration (Card 2001, 2005; Borjas 2003, Aydemir and Borjas 2007, Ottaviano and Peri 2008), because the effects of immigration have been considered passing mainly throught the labor market, but it is just one outcome of interest (Hanson 2008). This is certainly true but

[1] United Nations, Department of Social affairs "Trend in total migrants stock: the 2005 revision" http://esa.un.org/migration

also restrictive: immigration by increasing the labor force will generate investment opportunities and capital accomulation (up to the point in which the marginal product of capital returns to its pre-shock value). Moreover immigrants may also affect TFP in host countries, they may promote specialization/complementarities (Ottaviano and Peri 2008) with natives and this increases the TFP; immigrants also bring new ideas reinforcing agglomeration economies. On the other hand it is possible that immigration induces the adoption of less productive technologies (unskilled labor intensive). For these reasons the effect of immigration on host countries per capita GDP, cannot be analysed exclusively through the labor market channel. Peri and Ortega (2009) analyse the effects of immigrants on the growth rate of each component of the GDP function: total factor productivity, employment and capital used in production. The importance of understanding the effects of immigrants and their skill level on host economies concerns mainly policy implications. The underlying idea is that immigrants not only increase the country's endowment of low wage workers, leading to a decrease in per capita GDP because of capital dilution, but they also bring some capital with them allowing for a potential positive effects on per capita GDP (Benhabib (1996); Kemnitz (2001)). This paper provides an econometric estimation (by using both OLS and IV models) of the impact of immigration flows and their skills content (here used as a proxy for selective immigration policies consequences) on per capita GDP and per hour worked GDP. In providing empirical evidence of the previous questions, in this paper we follow the procedure by Frankel and Romer (1999) and recently adopted by Ortega and Peri (2009). To build the instrumental variables for international migration (both total and only skilled migrants) we firstly estimate bilateral flows of migration using a gravity-style model, and then we aggregate the fitted values by destination countries. In the second part of the paper we use instrumental variable to investigate the effects of immigrants flows on income. With respect the existing litterature in this field, we try to keep the effect of immigration on per capita GDP by stressing the role of being skilled among immigrants. The rest of the paper is organized as follows: section 2 provides a short review of the existing literature on the effects of immigration on the host economy; section 3 reports some descriptive statistics about migrants and their skill level; section 4 presents the empirical model, econometric strategy and results. Section 5 concludes.

2 Literature Review

From a theoretical point of view the effects of immigration on host country's income has been widely treated. Early models on the effects of labor mobility considered immigration in an extended version of the traditional Solow-Swan model, where, by assuming immigrants endowed with zero human capital, immigration is like an increase in the country's unskilled population so that everything else being constant, immigration leads to a lower per capita income because of the local capital dilution. Benhabib (1996) assumed immigrants endowed with some kind of capital, this may offset the dilution of local physical capital and some economic gain terms of per capita GDP is allowed for. Borjas (1995) introduced the notion of "immigration surplus", defined as the overall receiving country gain from immigration. Starting from an initial equilibrium in terms of income, employment and wage without migration, when workers are freely allowed to migrate, the labor endowment in receiving countries rises and the new internal equilibrium will be characterized by lower national wage and higher employment and national income. The difference with respect to the initial equilibrium is the so called "immigrants surplus"[2]. Hanson (2008) studies the welfare consequences of immigration by assuming heterogeneity of workers in terms of their skill level and perfect substitutability between native and foreign-born workers, he shows that when low-skilled workers are allowed to freely move between countries, there will be migration from low wage countries to high wage countries until the wage will equalize. In receiving country home-born unskilled workers lose while the native high-skilled workers win in terms of surplus. We may conclude that theoretically the effects of migration depends on the kind of immigrants: if the physical capital endowment provided by immigrants is lower than the average native capital endowment the effect of immigration will be negative in terms of per capita GDP. But from the empirical point of view the question is still open. In a seminal paper Dolado, Goria and Ichino (1994) found a negative effect of immigration on per capita income growth, so they argued that this was due to the fact that immigrants in OECD countries have lower human capital than natives. But, except for the contribution by Dolado, Goria and

[2] Borjas (2006) uses data from 1960 to 2000 to calculate the immigration surplus, in a simulation exercise he assumes 0.7 labor's share of national income and a 10% increase in the supply of workers in a skill group, this reduces the wage of that group by 3.5% (elasticity of factor price for labor). He finds also that the immigration surplus in USA was 1 billion dollars in 1960 and 21.5 billion dollars in 2000. But, immigration doesn't just increase the cake (GDP), it also affects the size of the slices: immigration reduced the total earnign of natives by 2.8% of GDP.

Ichino (1994), up to now empirical research on the economic effects of immigration focused mainly on the labor market effects[3] of migration. The reason is that immigration has been viewed as an additional labor force endowmend, so the labor market has been considered the only channel through which immigration may affect GDP in the host countries. Recently the paper by Ortega and Peri (2009) analizes the effects of immigration through the growth rate fo each component of the GDP function. In order to solve the endogeneity problem, they used the estimated bilateral immigration flows (without wage differential) to build their instrumental variable. Thus they use 2SLS estimates to analyse the effects of immigration on each component of the GDP function. In particuar they show that an increasing immigration leads to: (i) an increasing employment growth, (ii) a decreasing hours per worker growth, (iii) an increasing capital growth and GDP. Felbermayr, Hiller and Sala (2008) investigate the effect of immigrants (by using the stock of immigrants in destination country) on per capita GDP in the host countries. Using a IV cross-section approach and controlling for institutional quality, trade and financial openess they find positive effect of immigration on per capita GDP: a 10% increase in the migrants stock leads to a 2.2% increase in per capita GDP. Similarly Bellini, Ottaviano, Pinelli and Prarolo (2009) find that the share of foreigners in total population has a positive effect of per capita GDP in EU destination regions. The two former are certainly interesting but they do not take into account the kind of migrants in determining the effects on per capita GDP. In this paper, similarly to Felbermayer, Hiller and Sala (2008) and Bellini *et.al.*(2009) we investigate the effects of immigration on per capita GDP in destination countries, but in addition on them, we decompose immigrants on the base of their education, because we are interested in understanding if the skill level of immigrants matter in finding the effect of immigration on host countries income. An attempt in this direction was by Mariya and Tritah (2009), who decomposed the effect of immigrantion on per capita GDP by education level of immigrants. But they shown only a negative impact of unskilled immigrants on per capita GDP and a null effect of skilled immigrants on per capita GDP. Moreover we use a panel data approach instead of cross-section analysis. In building our instrumental variable we use the

[3] Card (2001, 2005), Borjas (2003), Aydemir and Borjas(2007), Borjas Grogger and Hanson (2008) find negative link between native low-skilled wages and immigrants. On the contrary Ottaviano and Peri (2008), find positive link between native wage and immigration.

Frankel and Romer (1999) approach used also by Ortega and Peri (2009).

3 Data and descriptive evidence

In this paper we combine an international panel data set on bilateral flows of migration from 86 poor and developing countries to 24 OECD countries with some macroeconomic and geographical variables concerning both origin and destination countries. Data on migration come from the International Migration Statistics (IMS) data set from OECD.stat[4]. Notice that this kind of data do not cover illegal migration. In this paper we use flows of migration from 1998 to 2007[5]. Macroeconomic variables such as per capita GDP[6], per hour worked GDP, population, number of patents, public and private expenditure in tertiary education[7] and bilateral aid have been taken from OECD.stat as well. From CEPII we take geographic variables such as the distance between countries, dummy variable for common language, past colonial relationship and contiguity of countries. Finally from Docquier, Lowell and Marfouk (2007) database we take data concerning the skill level of immigrants. This dataset contains the stock in 2000 and 1991 of immigrants and native workforce by skill level and origin country. Before going to the econometric estimation we want to point out some descriptive evidence on the settlement of immigrants and their skill level.

Figure 1 shows the share of tertiary educated over total immigrants stock and the share of immigrants over total population in 2000 for each destination country; as one may expect the main immigrants endowed countries are Luxembourg, Australia and Switzerland; while Italy, Hungary, Portugal and Finland are the less endowed. By the point of view of the skill level of immigrants, Australia, Canada, Ireland, New Zealand and United States have the higher share of tertiary

[4]Here immigrants are defined as the number of foreign born individuals entering in the country with a residence permit at least for one year. So our measure is unaffected by national naturalization policies.

[5]Notice that the disaggregated data on migration flows (by origin and destination countries) don't cover the 100% of total immigrants inflows in each destination countries, for example the total immigration inflow in Italy in 2007 by origin country is the 91% of the total immigrants inflows of immigrants; so the disaggregated data set contains some zeros for some origin-destination pairs. So some of these observation are truly zero flows, while others correspond probably to small flows.

[6]Per capita GDP is provided in USD at consant prices.

[7]Expenditure in tertiary education was initially provided in national currency at current price; but we transform them in USD by using exchange rates from UIC dataset and we clear for inflation but dividing for consumer price index.

educated immigrants, this is certainly the consequence of skilled immigrants oriented policies[8]. A second feature arising from the data is the decreasing persistency of immigrants inflows localization along time (figure 2). One may notice that the stock of immigrants in 1991 is well correlated (slope statistically different from zero) with the inflows of immigrants over total population in 1998, but not well correlated with the inflows of immigrants over total population in 2007. Figure 3 shows the positive and statistically significant correlation between the share of tertiary educated over total immigrants in 2000 and the stock of tertiary educated over total native workforce. It is interesting to notice that United States and Canada have the highest shares of tertiary educated immigrants and natives; on the contrary Portugal and Italy have the lowest share of tertiary educated immigrants and natives. Figure 3 also shows the relation between the share of tertiary educated over total immigrants in 2000 and the share of immigrants over total resident population, it seems that tertiary educated immigrants go in average where all other immigrants localize.

4 Empirical Strategy

The main finding of theoretical models in literature is that the effect of immigration depends on whether immigrants own more or less capital than natives. So, by increasing the capital owned by each immigrant, host countries may mitigate the expected negative effect of immigration on per capita GDP. In this paper we approximate the capital content of immigrants by their skill level. Thus we analyse the effects of immigrants inflows and their skill level (as we'll show in section 5.2 we use an interacted variable to this end) on income in destination countries (per capita GDP). This kind of empirical works are not common in literature, exceptions are Dolado, Goria and Ichino (1994), Felbermayer, Hiller and Sala (2008), Peri and Ortega (2009) and Bellini *et.al.* (2009), because of a series of econometric problems such as endogeneity from migrants localization,

[8] Immigrants selective immigration policies have been carried out in different ways by countries. For example United States adopt the so called H-1B visa to select skilled immigrants, but other systems are the Canadian or Australian "point system".

internal migration[9] and data availability[10]. To this end the empirical strategy consists of two main parts, in the first we build the instrumental variables using the Frankel and Romer (1999) approach also used by Ortega and Peri (2009) to solve the endogeneity problem and in the second we estimate a 2SLS model that will provide to us a sign to the effects of immigration on economic performance.

4.1 The empirical approach: problems and solutions

One main problem arises in empirical estimation when migration is involved as independent variable: *endogeneity from immigrants localization choice.* Endogeneity arises if immigrants choose where to stay on the basis of country's wage or GDP differentials within origin and destination countries. Thus it is true not only that immigration drives economic performances (or labor market changes), but also that local economic performances drive immigration. This problem leads to a biased estimation of the effects of immigration on economic performances. The endogeneity problem can be solved by using instrumental variables: if one can find a variable correlated with the change in immigrants presence but independent by the local economic performance, the bias due to immigration choice can be removed. When immigrants choose the country where to stay, they can take into account also other aspects of a region, such as existing networks and the presence of a community with the same culture and language. Thus, besides economic performance reasons, immigrants may tend to settle in countries (or cities) with high density of immigrants. Since the stock of existing immigrants in a region is unlikely to be correlated with current economic shocks (notice that a sufficient time lag is necessary), historic settlement pattern may solve the endogeneity problem. Figure 4 shows not statistically significant, even if positive, correlation between the stock of immigrants in 1991 and the per capita GDP in 1998 and 2007[11]. Altonji and Card (2001) used the stock of immigrants in 1970 as an instrumental variable for the change in immigrant population

[9] the problem of internal migration does not affect our analysis because it will be conduct at country level. Internal migration introduces a negative bias in sub-national level estimations (Hanson 2008).

[10] Low quality data problem can be solved by providing some reasons for caution in using the foreign born by total residents: (i) a considerable number of foreign born workers in manufacturing industries are skilled (and the education level is hardly comparable between host and origin country); (ii) not all native born workers are skilled and (iii) not all immigrants participate in the labor market, particularly following an intense process of family regrouping in recent years (Friedberg and Hunt 1995).

[11] We chosen 1998 and 2007 as starting and ending years of our panel.

between 1970 and 1980 in USA cities. The logic is the following: new immigrants tend to go where other immigrants already reside, but this variable is uncorrelated with local economic outcomes or wages. An alternative way to overcome the endogeneity problem was recently proposed by Mayda (2008) and used by Ortega and Peri (2009) and Felbermayr, Hiller and Sala (2008). They estimated the gravity-push bilateral immigration flows without economic determinants, and thus the fit of this regression was used as an instrumental variable (by aggregating data for each destination country). In this way the instrumental variable results to be well correlated with immigration flows and mainly independent from economic shocks[12]. In this paper we follow the Ortega and Peri (2009) approach[13]. Hence, our empirical approach consists of two steps, firstly we'll estimate the bilateral flows of immigrants (both total and skilled ones) by using geographic and strictly exogenous determinants of migration[14], and we'll aggregate the flows of immigrants from all origin countries for each destination country[15] (in this way for each destination country we have an estimated immigrants inflows not driven by economic performance as instruments). The second step is to estimate the effects of immigration on host countries income by using a 2SLS estimation.

4.2 Constructing the Instruments

Our final purpose is to estimate the effect of both immigrants inflow and its skill content on host country's income, thus we have two potentially endogenous variables in our main equation. So we need at least two instrumental variables to correctly identify the model and overcome the endogeneity problem. As anticipated in the former section we build these two instruments by estimating bilateral flows of both total and skilled migration using geographic and strictly exogenous determinants. An instrumental variable has to satisfy two requirements: it must explain quite well

[12] This is true under the condition that regressors used to estimate the bilateral immigration flows are independent from any economic shock.

[13] We also tried to use the instrument by Card (2001) using the stock of immigrants in 1990 as a base year for our instrumental variable. But we preferred the approach by Ortega and Peri (2009) because it better explains the actual immigration flows than the instrument à la Card (2001).

[14] For example we did not use wage differential between origin and destination country that has a strong explanatory power for migrants flows but it would introduce a bias in our estimates.

[15] We cannot put the determinants of immigrants flows directly as instrumental variables in the 2SLS procedure because most of them are time invariant and they would be perfectly correlated with the fixed effect in the first stage regression.

the endogenous variable (relevance) and it has to be orthogonal to the error process (validity). In what follows we build the instrumental variables and we will discuss the quality of the instruments providing both qualitative arguments on the exogeneity of variables used to build our instruments and formal test of relavance and validity of the so built instruments.

4.2.1 The bilateral migration flows equations

Our instrumental variables are the estimated immigrants inflows resulting from the estimation of bilateral migration flows from poor countries to 24 OECD countries (figure 5 reports the countries of origin and destination used in the estimation). We used data at country level because, as Borjas and Katz (2007), and Ottaviano and Peri (2008) argued, the country is the appropriate unit with which to analyze the effects of migration. The reason is the high degree of mobility of workers and capital within country. In our setting we need two instruments, one should look at explaining mainly the entire immigrants inflows into destination country, and the other mainly looking at the skilled immigrants inflows (since the interacted variable in the main equation points to measure the effect of being skilled among immigrants). So we estimated the inflows of immigrants by using two sets of explanatory variables: one set of variables explaining indifferently high and low skilled immigrants inflows, the other set explaining mainly high skilled immigrants inflows. In defining the set of variables explaining the overall bilateral migration flows (equation 1) we use three main features in literature: (i) migration is positively correlated with bilateral aid (Berthelemy, Beuran, Maurel 2009); (ii) migration is positively correlated with past immigrants settlements (Card 2001; Beine, Docquier and Ozden 2009); (iii) geographic variables are important to estimate bilateral migration flows (Mayda 2008; Berthelemy, Beuran, Maurel 2009; Peri and Ortega 2009). Thus the overall bilateral flows for immigrants have been estimated by using the following equation:

$$
\begin{aligned}
[1]\ \ln(immi\_flows_{d,o,t}) = \alpha_{o,t} + \gamma_1 \ln(aid_{d,o,t}) + \gamma_2 \ln(immi\_stock_{d,1991}) + \\
+\gamma_3 distance_{d,o} + \gamma_4 language_{d,o} + \\
+\gamma_5 contiguity_{d,o} + \gamma_6 colony_{d,o} + \varsigma_{o,d,t}
\end{aligned}
$$

To be sure about the exogeneity of the fitted immigration share from [1] we briefly discuss the exogeneity (and the intuition behind) of each regressor. It is straightforward to consider bilateral aid ($aid_{d,o,t}$) as independent from the destination country's economic performance because of bilateral aid is mainly exogenous decision by national governments (as an example the overall aid expenditure by United States is lower than the aid expenditure of Portugal, Spain and New Zealand) and on the goodness of political relation with the receiving country. As in Berthelemy, Beuran and Maurel (2009) bilateral aid is expected to have a positive effects on bilateral migration flows through the so called "attraction" effect: more bilateral aid from a "rich country" (destination country in our setting) to a "poor country" (origin country in our case) intensifies the attractiveness of the donor for workers in the "poor countries"; moreover bilateral aid increases the information in poor countries about the donor and it will reduce migration costs. The stock of immigrants in destination country in 1991 ($immi\_stock_{d,1991}$) is expected to have a positive effects on bilateral migration because immigrants already living in the destination country reduce the cost of information on how to get a job in the new country, on social system, immigration policy and culture. The stock of immigrants in 1991 may be considered exogenous because of a sufficient time lag with respect per capita income in the main equation (where economic performances go from 1998 to 2007). Moreover, the stock of immigrants in a decade before has been used as instrumental variable in various papers in literature (Card 2001, Cortes 2008)[16]. Evidence of the exogeneity of the stock of immigrants in 1991 with respect economic performance in 1998-2007 is provided in figure 4, where the correlation between the per capita GDP and the stock of immigrants is positive but not statistically different from zero. Finally, geographic variables concerning destination and origin countries are distance ($distance_{d,o}$)[17], the existence of a common language ($language_{d,o}$), the existence of a present or past colonial link ($colony_{d,o}$) and geographic contiguity ($contiguity_{d,o}$). All the geographic variables can be easily considered as exogenous. The distance between origin and destination countries may

[16] The underlying idea is that unobserved factors determining that more immigrants decided to locate in country "A" rather than in country "B" in 1991 are not correlated with changes in the relative economic performances by the two countries.

[17] In our estimation we used the population weighted distance, where the distance in Km between the largest cities in the two countries (origin, destination) is weighted for the share of those cities over the total country's population (see Frankel and Romer 1999). This is because the larger is a country the farther is the distance from other countries, so if we do not weight the distance for the population we may end up with migration flows positively affected by distance.

be considered as a proxy for the cost of migration, the further away are the two countries the higher is the cost for migration. Common land border is likely to encourage migration because of lower travel time (and costs). Past or present colonial relationship should increase bilateral flows of migration because of a strong political relation between the two countries.

The second instrumental variable comes from the estimated bilateral skilled immigrants flows as in the following equation:

$$[2]\ \ln(skilled\_immi\_flows_{d,o,t}) = \alpha_{o,t} + \beta_1 \ln(edu\_exp_{d,t}) + \beta_2 \ln(patent_{d,t}) + \\ +\beta_3 distance_{d,o} + \beta_4 language_{d,o} + \\ +\beta_5 contiguity_{d,o} + \beta_6 colony_{d,o} + \varsigma_{o,d,t}$$

where the skilled immigrants bilateral flows are the product between the bilateral flows of immigrants at time t and the share of tertiary educated immigrants stock in 2000:

$$[3]\ skilled\_immi\_flows_{d,o,t} = immi\_flows_{d,o,t} * \left(\frac{skilled\_immi\_stock_{d,o,2000}}{immi\_stock_{d,o,2000}}\right).$$

In order to estimate the skilled immigrants flows we used regressors explaining mainly tertiary educated immigrants flows. Destination countries with both an high expenditure in tertiary education[18] ($edu\_exp_{d,t}$) and an high number of patents[19] (*patent*) should attract in particular tertiary educated immigrants. These two variables may also be considered exogenous with respect per capita GDP because it is difficult to think that expenditure in education and patents could have relevant effects on income in the same year[20], except through their impact on the attractiveness of skilled immigrants. Moreover, the expenditure in tertiary level education may be considered exogenous with respect per capita GDP because this kind of expenditure is mainly policy driven (it is not necessarily true that the more is the GDP the more is the expenditure in tertiary level education). The number of patents depends upon the innovation activities by firms and institution and scarcely depends on the income in destination countries (per capita GDP).

[18] It is the expenditure of or for public and private institutions.

[19] Number of patent applications to EPO per thousands of inhabitants in the inventor's country of residence.

[20] We know that in the long run expenditure in education and innovation activities bring to raise income, but in our estimation they are used at the same year of income.

After estimating equations [1] and [2] we have the fitted values for bilateral flows of immigration, then we can aggregate this flows for each destination country ending up with the estimated inflows of both total and skilled immigrants in each destination country form 1998 to 2007, and these will be our instrumental variables.

4.2.2 Results

Equation [1] and [2] have been estimated by a fixed effect panel model, the origin-time fixed effects captures any economic, demographic and cost determinant of migration out of country o which varies over time; this fixed effects captures the so called "push-factors" of immigration which depend only on conditions in the countries of origin (it is independent of the destination countries characteristics) such as the per capita GDP, wage level in the origin countries or the share of young over the total population. Since the fixed effect is origin country but also time specific, it will keep also some historical (exogenous) shocks in the immigration flows. For example, the 2004 European Union enlargement probably caused a great increase in the emigration rate from new member countries toward old member countries (especially for those with common borders); this kind of shocks have been taken into account by the origin-time fixed effects. We decided to use origin country-time fixed effects because we want explicitly account for the geographic variables that are origin-destination specific and we cannot use destination-time fixed effects because it would keep some destination country's specific economic aspects. The geographic variables are destination-origin country specific and so capture the fixed bilateral cost of migration.

Figure 6 shows the results from the estimated equation [1][21]. All the explanatory variables are strongly significant and, as we expected, bilateral aid positively affects migration flows from origin to destination country, this is coherent with results in Berthelemy, Beuran and Maurel (2009). The stock of immigrants in destination countries in 1991 has a positive effects on migration flows confirming a well known results in literature (Card 2001). Geographic variables are significant. As we argued, common language, contiguity and colonial relationship affect positively bilateral

[21] Notice that although we have 24 destination countries, 86 origin countries and 10 years, we estimated equation [1] using just 4945 observations because of an huge number of missing values for bilateral flows of immigrants and international aid in OECD dataset.

migration flows, while distance negatively affects migration flows. This result is coherent with both Mayda (2008), Ortega and Peri (2009) and Berthelemy, Beuran and Maurel (2009). The fitted values of regression [1] are the estimated bilateral flows of immigrants from origin countries to destination countries. Notice that the set of destination countries has been removed from the set of origin countries[22], moreover origin countries are mainly poor or developing countries, so on the average with a worse educational system than in rich countries. For this reason, the estimated values of bilateral flows keep those migrants with a lower quality of education with respect natives even if formally they are tertiary educated as well.

Figure 7 show the results for estimated equation [2][23]. As we expected both the expenditure in tertiary level education and the number of patent in destination countries attract the inflows of tertiary educated immigrants (coefficients positive and significant). Coefficients associated to geographic variables have the same signs as in estimation [1].

Since the bilateral immigration flows may be left censored at zero, as a robustness check we also estimated equations [1] and [2] by using a panel tobit model. The underlying idea is that the flows of immigrants is broadly a continuous variable but it is subject to a lower limit[24]. The result of the tobit estimation is shown in the last column in figures 6 and 7, the values of the coefficients are mainly the same as the model in column (3), the correlation index between the fitted values in models (3) and (4) are close to one. Moreover the agglomeration of zeros in the data set is negligible, so the bias due to a simple OLS estimation is negligible too. Because the agglomeration of zeros in the data set is negligible and the fitted values resulting from the OLS estimation are more similar to the actual values in term of magnitude, we use the fitted values of the OLS model as instrumental variable in our 2SLS estimation[25].

[22] This choice has been forced by the fact that bilateral flows of aid in OECD database did not include destination countries as receiving aid countries.

[23] Notice that although we have 24 destination countries, 86 origin countries and 10 years, we estimated equation [2] using just 8427 observations because of an huge number of missing values for bilateral flows of immigrants in OECD dataset.

[24] See also Beine, Docquier and Ozden (2009) and Felbermayr, Hiller and Sala (2008).

[25] Results of the 2SLS procedure using the estimated bilateral immigrants flows using tobit estimation are equal to those by using OLS.

4.2.3 The quality of the instruments

An instrumental variable must satisfy two requirements: it must be correlated with the endogenous variables (relevance) and orthogonal to the error process (validity). The former condition may be tested by looking at the fit of the first stage regressions; usually one should look at the R^2 or at the F-stat of joint significance of the instruments in the first stage regression. Unfortunately, these indicators may not be sufficiently informative because we have two endogenous regressors. Indeed there may be the case that only one of the two instruments is highly correlated with the two endogenous regressors and the other is just noise, giving however high first stage R^2 or F-stat in the first stage regressions, but the model is basically unidentified.

In order to show the relevance of the so built instrumental variable, in figure 8 we report the scatter plots of the actual values for immigrants inflows, both total and skilled one, against the fitted values of respectively estimated equations [1] and [2]. The correlation between actual values and fitted values is positive and quite significant, so our instruments are good proxies for actual values of immigrants inflows. To strengthen this evidence we also regress actual values of migration against the fitted values from equations [1] and [2] and a constant term, results are shown in figure 9. As expected the coefficient on the fitted values of total immigrants flows is significant and close to one in explaining the actual values of total migration flows; similarly the estimated values of skilled migration flows has a significant coefficient close to one in explaining the flows of skilled migrants. Finally we also look at the Kleibergen-Paap F statistic as a weak identification test (results are in figure 10) and we can reject the null of weakly identified first stage equation.

Unfortunately we cannot directly test the validity of the instrumental variables (Sargan or Hansen test) because the Hansen J test for overidentifying restriction is not valid in the just identified model (Cameron and Trivedi 2009). So firstly we rely on the former discussion about the exogeneity of the determinants of bilateral migration flows but we also provide a formal overidentitying test by adding three surely orthogonal (even if irrelevant[26]) instruments and test a subset of overidentifying restriction (Baum, Schaffer and Stillman 2003). The idea is to transform the model

[26] We don't care about relevance of the added instruments because they are used only to test the exogeneity of our two actual instruments.

into an overidentified model, in order to have a group of orthogonal instruments and a group of suspect non-orthogonal instruments (i.e. our actual instruments described in the former section); thus we estimate a restricted model[27] with only surely orthogonal instruments and an unrestricted model with all the instruments (containing the suspect instruments). If the inclusion of suspect instruments increases significantly the Hansen J statistics, we would have good reasons for doubting the orthogonality of our suspect instruments[28]. We could not reject the null of exogeneity of suspect instruments, so we may conclude that the estimated flows of total and skilled migrants (from equation [1] and [2]) are valid instruments.

4.3 Estimates of Immigration's effects on income

4.3.1 Specification

Having our two instrumental variables, we are allowed to estimate the effect of immigrants and their skill level on per capita GDP by using the following equation:

$$[4]\ \ln y_{d,t} = \alpha_d + \beta_1 \ln(immi\_share_{d,t}) + \beta_2[\ln(immi\_share_{d,t}) * \ln(immi\_skill_d)] + \varepsilon_{d,t}{}^{29}$$

where d stands for destination country, t stands for time, $y_{d,t}$ is per capita GDP, $immi\_share_{d,t}$ is the immigrants inflows in country d at time t over the total resident population in the destination country, $immi\_skill_d$ is a measure of the capital (skill level) owned by immigrants; this variable is time invariant since it comes from a stock measure of immigration in 2000 per education level.

In panel data context, it is ofted assumed that observations on the same individual (cluster) in two different time periods are correlated (Baum, Schaffer and Stillman 2003), but observations on two different individuals are not; so in estimating equation [4] we properly accounted for cluster robust standard errors. Given the equation [4] the coefficient β_1 measures the average effect of

[27] Since the restricted model has to be identified as well, the number of added and surely orthogonal instruments has to be at least equal to the number of problematic variables.

[28] Practically, we added three surely orthogonal instruments with respect per capita GDP, from the OECD stat we choose the number of deaths for suicide and for diabets per 100000 inhabitants and the alcohol consumption per capita.

[29] The variable $\ln(immi\_skill_d)$ could not be put in the estimated equation because it is time invariant and it is perfectly correlated with the fixed effects α_d. Since the effect of the skill proportion of immigrants is kept by α_d we do not incur in omitted variable problem.

immigrants inflows on $y_{d,t}$, but our main purpose is to understand if immigration affects income differently by skill level, to this end the interacted variable was put in the estimation equation [4]. Thus β_2 measures how being tertiary educated among immigrants changes the average effects of immigrants on per capita GDP. So potentially the effect of a selective immigration policy (aimed to increase the share of tertiary educated over total immigrants) on per capita GDP can be evaluated by looking at β_2. As a proxy for the skill content by immigrants has been used the share between tertiaty educated immigrants stock in 2000 over the total immigrants in each destination country, this measure points to evaluate the effects of an increase in the high skilled immigrants endowment (due for example to a selective immigration policy). Notice that the role of the level of tertiary educated home born workers is kept by the fixed effect (the idea is that the lower is the endowment of native high skilled workers, the higher is the positive effects of an high skilled immigrant). As stated in the former section, an OLS model introduces a bias in our estimation, so we need an IV panel model (2SLS)[30]. So in the first stage regressions we need at least two instrumental variables to correctly identify the model. Our instruments are two estimated immigrants inflows in [1] and [2], aggregated for each destination country and weighted for the population in each country ($est\_immi\_share_{d,t}$ and $est\_skilled\_immi\_share_{d,t}$ in what follows). Thus, our two first stage regressions have the following form:

$$[5]\ \ln(immi\_share_{d,t}) = \alpha_d + \theta_1 \ln(est\_immi\_share_{d,t}) + \\ + \theta_2 \ln(est\_skilled\_immi\_share_{d,t}) + \nu_{d,t}$$

$$[6]\ \ln(immi\_share_{d,t})^* \ln(immi\_skill_d) = \alpha_d + \varphi_1 \ln(est\_immi\_share_{d,t}) + \\ + \varphi_2 \ln(est\_skilled\_immi\_share_{d,t}) + \varsigma_{d,t}$$

The destination country's fixed effect in [4] explains all those factors that are country specific and may influence per capita GDP.

[30] Notice that part of the endogeneity problem due to the omitted variables problem is cleared out by the country's fixed effects.

4.3.2 Basic results

Figure 11 reports the estimation of [4] by using simple OLS model (fixed effects panel model) and IV panel model. The coefficients associated to the share of immigrants inflows are negative and significant for both OLS and IV estimation. The coefficients associated to the interacted variable are positive and very significant. The results for the Durbin-Wu-Hausman test in figure 11 confirm the bias in the OLS estimation due to the endogeneity problem[31]. So we have to look at the IV estimation results, and we may conclude that a 1% increase in the immigrants inflows leads to a 0.69% reduction in per capita GDP, but being skilled among immigrants mitigates this negative effects. Since the coefficient associated to the immigrants share is always greater than the coefficient associated to the interacted variable (skill content of immigration), we may conclude that *being tertiary educated among immigrants positively affects per capita GDP but not enough to clear the negative effect of immigration.* In particular being tertiary educated among immigrants increase per capita GDP by 0.31%. With respect the paper by Mariya and Tritah (2009), which has the merit to accounting for immigrants heterogeneity in determining the effect on per capita GDP, here we find strong and significant positive effect on per capita GDP of being skilled among immigrants.

Figure 10 reports results for the first stage regressions [5] and [6], our instrumental variables explain well our problematic variables: all coefficient are statistically positive and different from zero, the R^2 of the first stages are quite good and the F-stat tests for zero slopes allow us to confirm the jointly significance of instrumental variables. But, unfortunately in presence of two endogenous variables (as in this case) the usual rules of thumbs may be misleading, so we computed the weak identification test (adjusted for the robust cluster heterogeneity) by using the Kleibergen-Paap F statistic, confirming that there are not problem on weak instruments.

The high negative effect of average immigrants on per capita GDP may have two possible explanations. A possible explanation relies on the fact that per capita GDP measure suffers of an

[31] The Durbin-Wu-Hanson test investigates if the correlation between the actual flows of immigrants are uncorrelated with the error component (exogeneity). Under the hypothesis that actual immigrants flows are uncorrelated with the error term, the OLS estimation are unbiased (as IV estimation) and efficient; so OLS and IV coefficients differs only because of sampling error. Since we can reject the null hypothesis, we conclude that OLS coefficients differ from IV, so OLS estimation are biased because of endogeneity of actual immigrants flows.

increase in the number of inactive immigrants. This is a well known feature in migration literature: family reunion involves inactive foreign born individuals (such as children). A second possible explanation is the assimilation problem. When a migrant arrives in his destination country, he takes time before finding a job, so it strongly negatively affects per capita GDP. To solve for the inactive immigrants problem we replicate the same estimation as before by using per hour worked GDP (this measure does not suffer the inflow of inactive population).

Figure 12 shows results when the dependent variable is per hour worked GDP, it is interesting to notice that the coefficients associated to immigration share are all lower than those in figure 11 and not statistically different from zero, this confirms our intuition that per capita GDP suffer of inactive immigrants. This results is in line with the widely accepted idea in literature that immigrants have a small negative effect on income in host countries. But the actual end of this paper is to understand if there is place for skill selective immigration policy, and the positive and significant coefficient for the interacted variable confirms that being skilled among immigrants has a positive effect on the host country's income.

To point out the assimilation problem we replicate the estimations in [4] - [6] by using different time lagged variables for the immigrants share and the skilled immigrants share. Figure 13 reports results for this estimation, showing that the negative effect of immigrants inflows is decreasing over time[32]. Moreover it is also interesting to notice that the share of skilled immigrants needed to clear the negative effect of immigration (i.e., the share between β_1/β_2) is decreasing over time.

4.3.3 Robustness

As a robustness check we replicate the same estimation for two other sub-samples of data: (i) high income countries obtained by excluding some poorest countries in the original sample (Poland, Hungary and Slovak Republic); (ii) low income countries obtained by excluding Netherlands, Norway, Switzerland and United States. Results in figures 10-12. For these two others samples used, the effect of average immigration on per capita GDP is still negative and significant, and the effect of

[32] Unfortunately coefficients for the overall immigrants lagged variables are not significant probably because of the reduced number of observation given to the time lags.

the interacted variable (in other words the effects of being tertiary educated among immigrants) is again positive and significant for both OLS and IV estimation. It is interesting to notice that the coefficient on the inflows of migrants for high income countries is more negative than for low income countries (while coefficient on the interacted variable remains roughly unchanged), this may be due to the fact than high income countries have already a higher stock of migrants than low income countries, and a further inflows of migrants in high income countries has a more negative effect than for low income countries.

As a further robustness check we replicate the same analysis by using the selection ratio to interact the immigrants flows. The selection ratio is the number of skilled over unskilled migrants, in our case it has been computed as the ratio between the stock in 2000 of tertiary educated immigrants over primary educated immigrants This variable is a proxy for the human capital structure of migration stock, but by interacting it with the flows of immigrants, we have a proxy for the human capital structure of the immigrants flows. For all the three samples used for the estimation, we obtain similar coefficient with respect the case in which the share of skilled immigrants was used to interact the immigrants flows. Figure 14 shows that a 1% increase in the human capital structure of immigrants flows (e.g. an increase in the number of skilled versus the number of unskilled immigrants) leads to a 0.27% increase in per capita GDP, but again, the negative effect of average immigrants inflows[33] overcompensates this positive effect. The same results are obtained by using the two subsamples defined before (high and low income countries). This confirms the theoretical results in Benhabib (1996) that the impact of immigration strongly depends on the human capital structure of immigrants flows. Finally, this also gives a role to a skill selective immigration policy (aimed to increase the selection ratio) in affecting positively income in host countries.

4.3.4 Why are the IV estimates greater than the OLS estimates?

As one may easily notice from figures 11, 12 and 14 coefficients estimated using IV are greater than those estimated using OLS. This is a good point for our results, and let's see why. The OLS estimates are given by the correlation between income and migration, while IV estimates are given

[33] First stage regressions results for this new estimations are reported in figure 10 (b).

by the correlation between income and the component of migration explained by our instrument. Thus, the fact that OLS estimates are smaller than IV ones, means that the correlation between income and the component of migration does not explained by our instrument (in other words the error term of the first stage regression) is weaker than its correlation with the component of migration explained by the instruments.

5 Conclusions

The aim of the paper was to investigate the effect of immigrants flow and its skill content on host country's income. Negative effect of immigrants arises under a neoclassical production function where immigrants are considered as an increase in low productive workers. But allowing for the possibility that migrants can bring with them some capital from their origin country, the capital dilution given by the increased population may be offset. Under this setting the effect of immigration on host countries income depends on the capital content of immigrants. So in the paper we estimated the effects of immigrants and their skill level on host countries income. We provide evidence of the positive effects of being skilled among immigrants by using instrumental variable panel data model (fixed effects for destination countries), but the total inflow of immigrants still have a negative effect on per capita GDP. In particular a 1% increase in the total immigrants inflows leads to a 0.69% decrease in per capita GDP, while being high skilled among immigrants contributes 0.32% positively on per capita GDP. Similarly, a 1% increase in the selection ratio of immigrants flows leads to a 0.27% increase in per capita GDP (but again it not enough to clear the negative effect of average immigrants inflows). So we may certainly conclude in favour of a skill selective immigration policy aimed to increase the share of skilled over unskilled immigrants. There are some reasons of why immigrants have a negative effect on per capita GDP. First, the problem of inactive immigrants that reduce itself per capita GDP measure, we solved this problem by using per hour worked GDP as dependent variable. By using the per hour worked GDP we obtain results in line with the literature about the effects of overall immigrants (Ortega and Peri 2009), that is, total immigrants have a small negative or null effects on per hour worked GDP; but being skilled among immigrants has still a positive effects on per hour worked GDP. Second, the assimilation problem, we provided evidence of this by using the lagged values of immigration flows to estimate the effects on per capita GDP. An other possible theoretical reason of the negative effect of immigrants on income is that the capital content of immigrants (from poor countries, as in our estimation) is even lower than the capital content of native workers in OECD countries (this is coherent with results in Dolado, Goria and Ichino (1994)). A further possible explanation of why immigration has negative effects on per capita GDP (even counting for its skill level) is that capital does not immediately adjust after immigrants inflows (this is the explanation given in literature for the negative effect of immigration on national wages); so a further step in this strand of literature would be to consider inflows of foreign capitals as a possible help in the adjustment of capital after immigration inflows.

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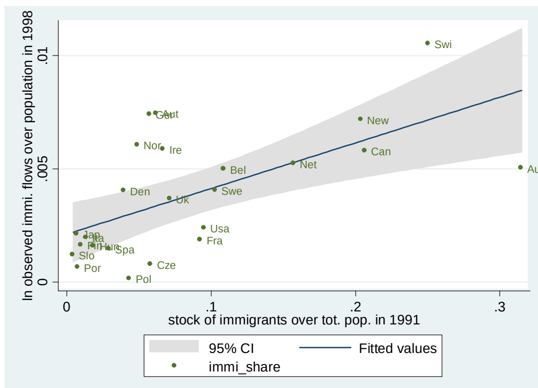
6 Tables and Figures

Figure 1: share of immigrants (stock 2000) over total population, and share of tertiary educated over total stock of immigrants in 2000. Source: F.Docquier, A. Marfouck and B.L. Lowell (2007).

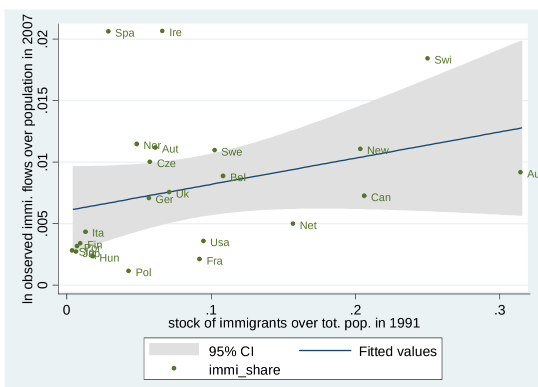
Country	Share of immigrants over total population	Share of tertiary educated immigrants
Australia	21.2	40.3
Austria	10.2	12.7
Belgium	8.9	19.8
Canada	15.1	58.8
Czech Republic	4.0	11.5
Denmark	4.3	17.3
Finland	1.7	23.8
France	6.1	16.4
Germany	5.7	21.8
Hungary	1.1	11.6
Ireland	7.4	41.1
Italy	1.6	15.4
Japan	0.8	28.1
Luxembourg	22.9	21.7
Netherlands	11.3	22.0
New Zealand	13.8	40.9
Norway	5.0	28.7
Poland	1.9	14.0
Portugal	1.4	18.6
Slovak Republic	0.7	15.2
Spain	3.9	18.5
Sweden	8.6	25.7
Switzerland	20.9	18.6
United Kingdom	6.0	34.9
United States	8.6	42.7

Figure 2: relation between the inflows of migrants and the stock of immigrants in 1991

(a)

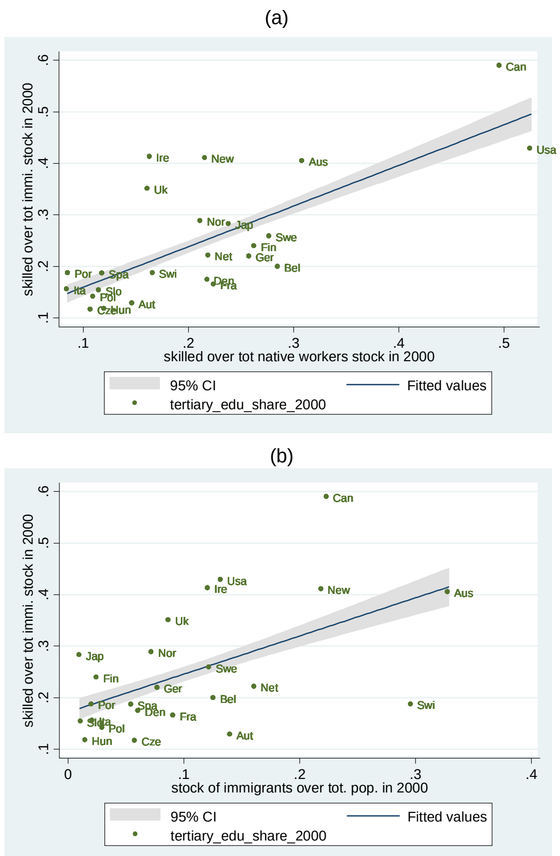


(b)



Source: F.Docquier, A.Marfouk and B.L. Lowell; and OECD.stat

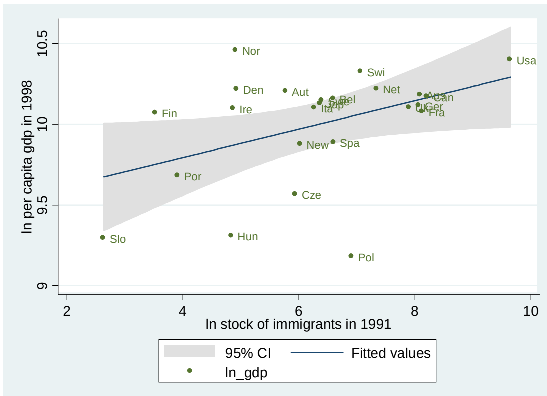
Figure 3: relation between the share of skilled immigrants in 2000 and: (a) the share of skilled native workers in 2000, (b) the share of immigrants over total population in 2000.



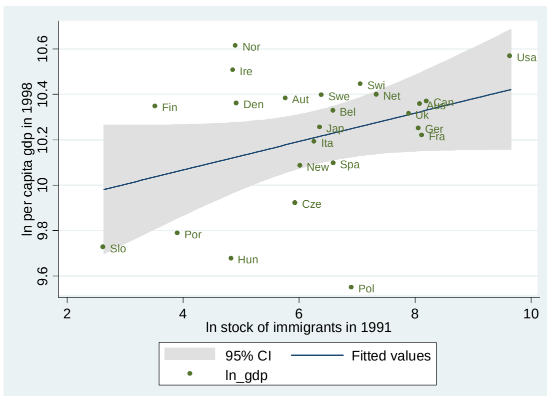
Source: F.Docquier, A.Marfouk and B.L. Lowell; and OECD.stat

Figure 4: relation between the stock of immigrants in 1991 and per capita gdp in 1998 (a) and 2008 (b)

(a)



(b)



Source: F.Docquier, A.Marfouk and B.L. Lowell; and OECD.stat

Figure 5: list of the destination and origin countries

Destination Countries	Origin Countries
Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom, United States	Albania, Algeria, Argentina, Bangladesh, Belarus, Bolivia, Brazil, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Congo, Costa Rica, Cote d'Ivoire, Croatia, Cuba, Cyprus, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Fiji, Georgia, Ghana, Guatemala, Guinea, Guyana, Haiti, Honduras, Hungary, Iceland, India, Iran, Iraq, Israel, Jamaica, Kenya, Korea, Lebanon, Liberia, Libya, Macedonia, Malaysia, Mali, Mauritania, Mexico, Morocco, Mozambique, Namibia, Nepal, Nicaragua, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Rwanda, Saudi Arabia, Senegal, Serbia, Sierra Leone, Singapore, Slovenia, Somalia, South Africa,Sri Lanka, Sudan, Suriname, Syria, Thailand, Togo, Tunisia, Ukraine, Uruguay, Venezuela, Viet Nam, Zambia, Zimbabwe.

Figure 6: results for bilateral migration flows estimation: 1998-2007 in 24 OECD countries from 86 poor and developing countries

Dependent variable	Bilateral immigrants flows in ln			
	(1)	(2)	(3)	(4)
ln_aid	0.37	0.289	0.216	0.217
	(33.97)***	(25.45)***	(19.36)***	(21.77)***
ln_immi_1991		0.377	0.436	0.378
		(23.13)***	(25.74)***	(25.20)***
D_contiguity			1.757	1.838
			(5.97)***	(7.64)***
D_common_language			1.079	0.838
			(17.05)***	(14.67)***
D_colonial_relationship			0.47	0.377
			(6.32)***	(5.19)***
weighted distance			-0.85	-0.72
			(19.39)***	(11.13)***
Observations	4945	4935	4935	4935
Number of id_push	766	766	766	766
R-squared within	0.223	0.32	0.41	
rho				0.322***

Absolute value of t statistics in parentheses

SE and statistics are robust to both arbitrary and intra-group heteroskedasticity

* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 7: results for bilateral skilled focused migration flows estimation: 1998-2007 in 24 OECD countries from 86 poor and developing countries

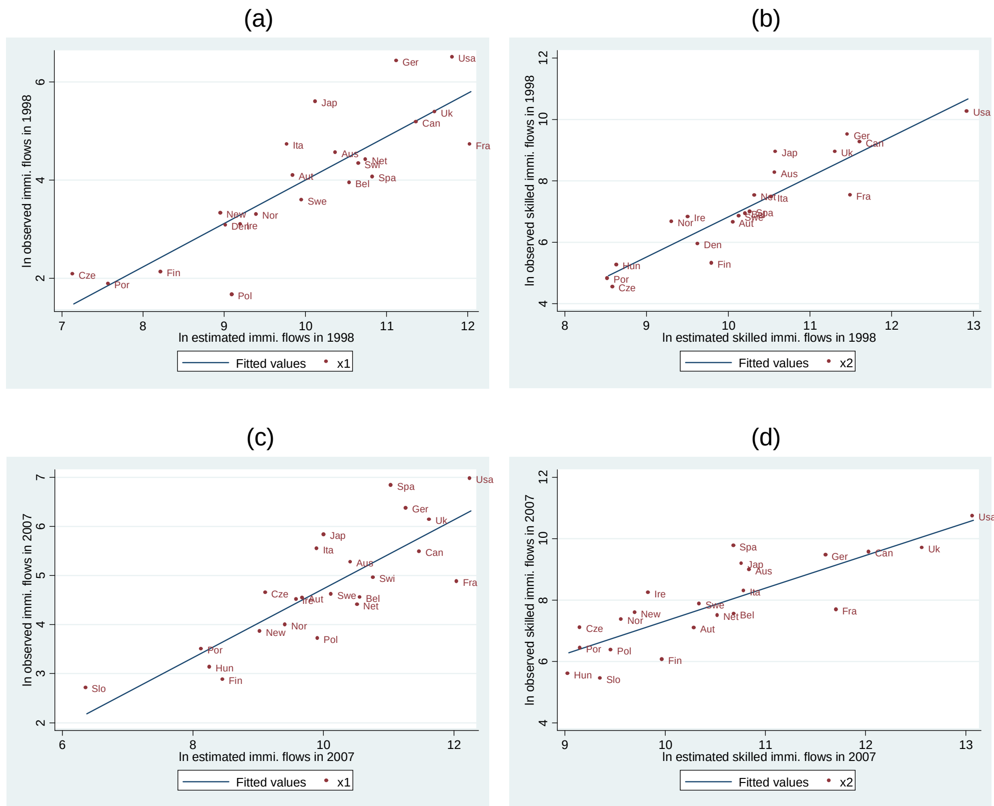
Dependent variable	Bilateral skilled immigrants flows in ln		
	(1)	(2)	(3)
Expenditure in tertiary edu (ln)	0.517	0.516	0.475
	(20.56)***	(24.29)***	(24.90)***
N°of patent (ln)	0.121	0.145	0.144
	(6.57)***	(7.24)***	(10.65)***
D_contiguity		0.675	0.765
		(7.24)***	(10.65)***
D_common_language		1.624	1.335
		(28.93)***	(26.93)***
D_colonial_relationship		0.249	0.266
		(3.27)***	(4.43)***
weighted distance		-0.555	-0.432
		(11.60)***	(10.32)***
Observations	8427	8427	8427
Number of id_push	1099	1099	1099
R-squared within	0.28	0.42	
rho			0.314***

Absolute value of t statistics in parentheses

SE and statistics are robust to both arbitrary and intra-group heteroskedasticity

* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 8: relation between the true immigrants inflows and the estimated inflows of immigrants as in model [1] and [2] in 1998 (a,b) and 2007 (c,d)



Source: F.Docquier, A.Marfouk and B.L. Lowell; and OECD.stat

Figure 9: relation between the actual and estimated flows of both immigrants and tertiary educated immigrants

Dependent variable	ln_immi	ln_skilled_immi
constant	-7.76 (6.21)***	-5.512 (3.43)***
ln_estimated_immi	1.221 (9.74)***	-
ln_estimated_skilled_immi	-	1.256 (8.08)***
Fixed Effects	Yes	Yes
R-sq	0.32	0.25
F-stat	94.85	65.36
Observations	229	219
Number of nuts	24	24

Absolute value of z statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 10: first stage regression results

(a)

	Complete Sample		High Income Countries		Low Income Countries	
Dependent variable	ln_immi_share	ln_immi_share*ln_immi_skill	ln_immi_share	ln_immi_share*ln_immi_skill	ln_immi_share	ln_immi_share*ln_immi_skill
immi fit share in ln	0.893	2.221	1.157	2.898	0.904	2.222
	(3.57)***	(3.61)***	(7.28)***	(5.82)***	(3.50)***	(3.46)***
skilled immi fit share in ln	0.785	2.421	0.708	2.257	0.773	2.391
	(2.28)**	(2.60)***	(2.00)*	(2.30)**	(2.22)**	(2.54)**
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.362	0.325	0.398	0.35	0.367	0.331
F test exclu. Ins.	13.66	18.09	84.21	68.49	13.41	17.19
Kleibergen-Paap F	9.77		12.03		11.64	
Observations	214	214	195	195	181	181
Number of nuts	24	24	21	21	20	20

Absolute value of z statistics in parentheses

SE and statistics are robust to both arbitrary and intra-group heteroskedasticity
* significant at 10%; ** significant at 5%; *** significant at 1%

(b)

	Complete Sample		High Income Countries		Low Income Countries	
Dependent variable	ln_immi_share	ln_immi_share* ln_selection_ratio	ln_immi_share	ln_immi_share* ln_selection_ratio	ln_immi_share	ln_immi_share* ln_selection_ratio
immi fit share in ln	0.893	3.006	1.157	3.943	0.904	3.022
	(3.57)***	(3.56)***	(7.28)***	(6.56)***	(3.50)***	(3.44)***
skilled immi fit share in ln	0.785	3.196	0.708	3.043	0.773	3.138
	(2.28)**	(2.54)**	(2.00)*	(2.23)**	(2.22)**	(2.48)**
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.362	0.325	0.398	0.356	0.367	0.33
F-stat	13.66	14.85	84.21	77.71	13.41	14.25
Kleibergen-Paap F	5.02		8.42		5.25	
Observations	214	214	195	195	181	181
Number of nuts	24	24	21	21	20	20

Absolute value of z statistics in parentheses
SE and statistics are robust to both arbitrary and intra-group heteroskedasticity
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 11: per capita GDP as dependent variable: 2SLS results

	Complete Sample		High Income Countries		Low Income Countries	
Dependent: per capita GDP	OLS	IV	OLS	IV	OLS	IV
ln_immi_share	-0.132	-0.691	-0.212	-0.706	-0.143	-0.604
	(1.86)*	(-1.70)*	(3.64)***	(-1.97)**	(1.84)*	(-1.68)*
ln_immi_share*	0.087	0.317	0.109	0.313	0.091	0.286
ln_immi_skill	(3.48)***	(2.11)**	(5.37)***	(2.41)**	(3.33)***	(2.15)**
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	79.89	15.49	90.28	11.94	70.4	17.5
DWH test	8.75		8.454		7.467	
Observations	238	214	208	195	198	181
Number of nuts	24	24	21	21	20	20

Absolute value of z statistics in
SE and statistics are robust to both arbitrary and intra-group heteroskedasticity
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 12: per hour worked GDP as dependent variable: 2SLS results

	Complete Sample		High Income Countries		Low Income Countries	
Dependent: per Hour GDP	OLS	IV	OLS	IV	OLS	IV
ln_immi_share	-0.017	-0.568	-0.103	-0.523	-0.014	-0.521
	(-0.26)	(-1.39)	(-1.72)*	(-1.44)	(0.19)	(-1.39)
ln_immi_share*	0.042	0.271	0.065	0.247	0.041	0.253
ln_immi_skill	(1.74)*	(1.79)*	(3.16)***	(1.88)*	(1.56)	(1.81)*
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	63.99	18.45	57.51	15.91	58.21	18.99
DWH test	8.591		7.686		7.439	
Observations	238	214	208	195	198	181
Number of nuts	24	24	21	21	20	20

Absolute value of z statistics in
SE and statistics are robust to both arbitrary and intra-group heteroskedasticity
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 13: per capita GDP as dependent variable with lagged immigration inflows

Hi income countries				
Dependent variable	Per capita GDP in ln			
	no lag	lag 1	lag 2	lag 5
ln_immi_share	-0.706	-0.629	-0.505	-0.243
	(-1.97)**	(1.63)	(1.55)	(0.44)
ln_immi_share* ln_immi_skill	0.313	0.283	0.233	0.129
	(2.41)**	(2.02)**	(2.02)**	(0.67)
Fixed Effects	Yes	Yes	Yes	Yes
beta1/beta2	2.26	2.22	2.17	1.88
Observations	195	176	156	98
Number of nuts	21	21	21	21

Absolute value of z statistics in parentheses

SE and statistics are robust to both arbitrary and intra-group heteroskedasticity

* significant at 10%; ** significant at 5%; ***

Figure 14: second stage regression results when the selection ratio has been used to interact the immigrants flows

(a)

	Complete Sample		High Income Countries		Low Income Countries	
Dependent: per capita GDP	OLS	IV	OLS	IV	OLS	IV
ln_immi_share	-0.085	-0.807	-0.207	-0.74	-0.087	-0.749
	(1.53)	(-1.76)*	(4.44)***	(2.40)**	(1.45)	(-1.70)*
ln_immi_share* ln_selection_ratio	0.053	0.269	0.08	0.24	0.054	0.253
	(3.61)***	(2.07)**	(6.64)***	(2.79)***	(3.39)***	(2.02)**
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	80.67	9.22	103.31	14.24	70.74	0.08
DWH test	9.712		9.817		8.63	
Observations	238	214	208	195	198	181
Number of nuts	24	24	21	21	20	20

Absolute value of z statistics in

SE and statistics are robust to both arbitrary and intra-group heteroskedasticity

* significant at 10%; ** significant at 5%; *** significant at 1%

(b)

	Complete Sample		High Income Countries		Low Income Countries	
Dependent: per Hour GDP	OLS	IV	OLS	IV	OLS	IV
ln_immi_share	0.017	-0.668	-0.108	-0.551	0.02	-0.649
	(0.31)	(-1.47)	(2.22)**	(-1.68)*	(0.35)	(-1.45)
ln_immi_share* ln_selection_ratio	0.023	0.23	0.05	0.19	0.022	0.225
	(1.58)	(1.76)*	(4.00)***	(2.09)**	(1.43)	(1.73)*
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	63.58	14.26	62.16	18.63	57.89	13.19
DWH test	8.546		8.118		7.427	
Observations	238	214	208	195	198	181
Number of nuts	24	24	21	21	20	20

Absolute value of z statistics in

SE and statistics are robust to both arbitrary and intra-group heteroskedasticity

* significant at 10%; ** significant at 5%; *** significant at 1%

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