DISCUSSION PAPER SERIES

IZA DP No. 5853

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July 2011

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

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Discussion Paper No. 5853
July 2011

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IZA Discussion Paper No. 5853
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ABSTRACT

Immigration, Unemployment and Growth in the Host Country: Bootstrap Panel Granger Causality Analysis on OECD Countries*

This paper examines the causality relationship between immigration, unemployment and economic growth of the host country. We employ the bootstrap panel Granger causality testing approach of Kónya (2006) that allows to test for causality on each individual country separably by accounting for dependence across countries. Using annual data over the period 1980-2005 for 22 OECD countries, we find that, only in Portugal, unemployment negatively causes immigration, while in any country, immigration does not cause unemployment. We also find that, in France, Iceland, Norway and United Kingdom, growth positively causes immigration, while in any country, immigration does not cause growth.

JEL Classification: E20, F22, J61

Keywords: immigration, growth, unemployment, Granger causality

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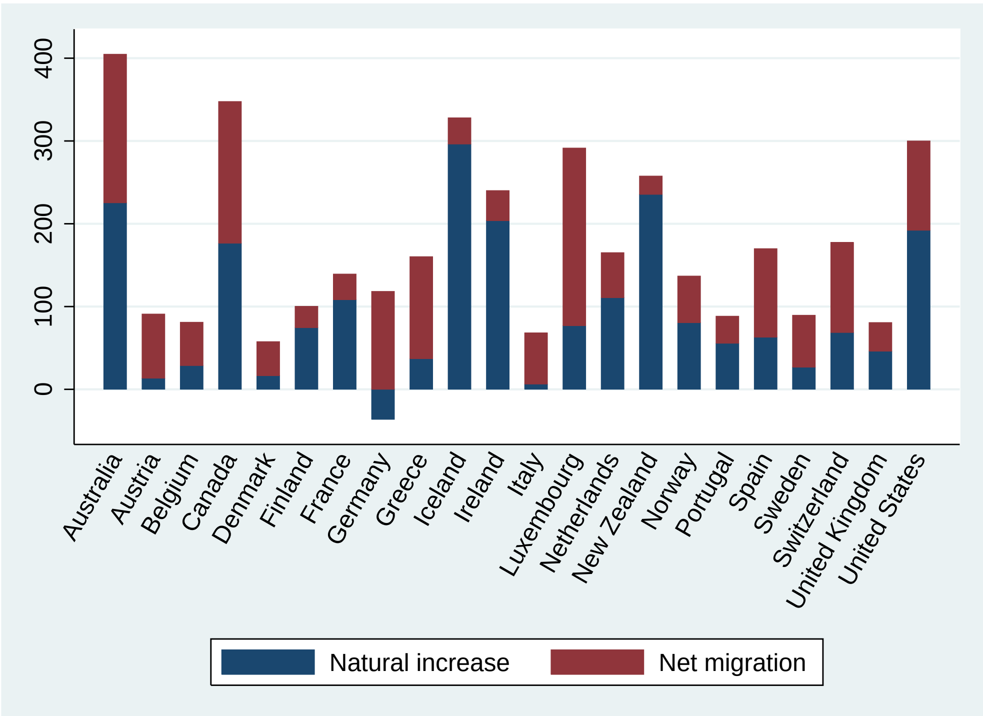
* We are grateful to the participants of the CEPII internal seminar, and of the XXV annual conference of the European Society for Population Economics for very helpful comments and suggestions on a previous version of this paper. Usual disclaimer applies.

1 Introduction

During the last decades, most OECD countries experienced an increase in international migration. Indeed, the number of immigrants received in OECD countries substantially increased in the last decades, from about 82 million in the 1990 to 127 million in the 2010 (United Nation, 2009). Immigrants are the main source of population growth in the OECD countries. They contribute more and more to population growth, compared to natural increase (the excess of births over deaths), particularly in European countries during the last years (Figure 1). In the context of the aging population and the shrinking working age population, migration flows are likely to continue at a sustained pace in the next decades.



Note: Variables are in per thousand persons in the population.

Figure 1: Components of population change, 1980-2005

However, there is a public and political concern about the impact of the international migration on economic conditions in the receiving countries. Economists have studied, both theoretically and empirically, the impact of immigration on a variety of host country outcomes[1] and also how economic

[1]See Okkerse (2008) for a review of literature.

conditions in the receiving countries affect migration flows.

The theoretical studies do not draw unambiguous conclusion for the effects of immigrants on un(employment) rates among residents and natives (Harris and Todaro, 1970; Ortega, 2000). Generally, the empirical studies on the impact of immigration on labour market in host countries conclude that migration flows do not reduce the labour market prospects of natives (Simon et al., 1993; Pischke and Velling, 1997; Dustmann et al., 2005; etc.).

The theoretical studies on the effect of immigration on growth show if migrants are skill an inflow of migrants will have a less negative effect on growth than that of natural increase in population(see Dolado et al., 1994; Barro and Sala-i-Martin, 1995). This result is corroborated by the findings from the empirical papers (see Dolado et al., 1994 and Ortega and Peri, 2009 among others).

Some empirical papers have examined the causality between immigration and unemployment and growth on data from different countries (Pope and Withers, 1985 ; Marr and Siklos, 1994; Islam, 2007 and Morley, 2006). The idea is based on the fact that migrants take into account job opportunities in their decision to migrate and the economic conditions are likely to have a significant impact on migrations policies. Generally, the empirical papers on causal link between immigration and host economic activity find no evidence of migration causing unemployment and growth, but find evidence of causation running in the opposite direction.

This paper contributes to the existing literature on immigration by investigating the causality relationship between immigration and host country economic conditions (unemployment and growth) using the panel Granger causality testing approach recently developed by Kònya (2006). This approach has several advantages. Firstly, it does not assume that the panel is homogeneous and allows to test for Granger-causality on each individual panel member separately by taking into account the possible contemporaneous correlation across countries (therefore generating country specific bootstrap critical values). Therefore, it allows to test the causality relationship between immigration and host economic variables by accounting for the heterogeneity in term immigration policy of each host country. Secondly, this approach which extends the framework by Phillips (1995) that tests for non-causality in levels VARs, in a time series context, does not require pretesting for unit roots and cointegration. This is an important feature since the unit-root and cointegration tests in general suffer from low power, and different tests often lead to contradictory outcomes. Thirdly, this panel Granger causality approach allows to detect for how many and for which members of the panel there exists one-way Granger-causality, two-way Granger-causality or no Granger-causality.

Using annual data over the period 1980-2005 for 22 OECD countries which are the major migrants-recipients countries, our study provides evidence that the interaction between immigration and host economic activity depends on the host country. Specifically, our finding suggests that, only in Portugal, unemployment negatively Granger causes immigration inflow, while in any country, immigration inflow does not Grange cause unemployment. Moreover, our results indicate that in four countries (France, Iceland, Norway and United Kingdom), economic growth positively Granger causes immigration inflow, while in any country, immigration inflow does not Granger cause economic growth.

The remainder of the paper is organized as follows. The existing literature on the interaction between immigration and unemployment and growth is reviewed in Section 2. Section 3 presents the econometric methodology. Section 4 describes the data and reports the empirical results. Finally, Section 5 offers some concluding remarks.

2 Literature review

Since the early 1980s a considerable literature on immigration has been developed. The main concern is about the effect of immigration on labour market and economic growth in the host country.

The theoretical studies about the effects of immigration on unemployment lead to ambiguous conclusion. Harris and Todaro (1970) use a two-sector model of migration and unemployment to describe the possible negative effects of immigration on natives employment opportunities in the presence of minimum wage. On the contrary, using a dynamic two-country labour matching model with free-entry of firms, Ortega (2000) finds a positive effect of immigration on natives employment opportunities. The theoretical papers by Johnson (1980), Borjas (1987), Schmidt et al. (1994) and Greenwood and Hunt (1995)) show that the effects of immigrants on the employment of residents depend on whether immigrants and natives are substitutes or complements in production. If the labour supply of residents and that of recent immigrants are substitutes, an inflow of immigrants will reduce the wage (assuming wage adjustment to clear the labour market) and will increase the total employment. If labour force participation rates are sensitive to real wage rates, part of adjustment will causes a decrease in natives unemployment. On the contrary, if residents and immigrant workers are complements in production (immigrants may be particularly adept at some types of jobs) the arrival of new immigrants may increase resident productivity and then raise theirs wages and theirs employment opportunities.

Some theoretical works (Dolado et al., 1994; Barro and Sala-i-Martin, 1995) use a Solow growth model augmented by human capital to analyze the effects of immigrants on growth. They conclude that the effects of migration on economic growth depend on the skill composition of immigrants. The more migrants are educated, the more immigration has a positive effect on growth of host country.

Generally, empirical studies on the impact of immigration on labour market in host countries conclude that migration flows do not reduce the labour market prospects of natives. For example, the empirical studies based on the spatial correlation approach (Simon et al., 1993 for the U.S; Pischke and Velling, 1997 for Germany; Dustmann et al., 2005 for the U.K.) find no adverse effects of immigration on native unemployment. This result is corroborated by finding from the studies on the natural experiments, i.e., immigration caused by political rather than economic factors (Card, 1990 for the Mariel Boatlift[2] and Hunt, 1992 for the repatriation of "pieds-noirs" form Algeria into France). Contrary to the studies mentioned above that are conducted at the country level, Angrist and Kugler (2003) use a panel of 18 European countries from 1983 to 1999 and find a slightly negative impact of immigrants on native labour market employment. Jean and Jimenez (2007) evaluate the unemployment impact of immigration (and its link with output and labour market policies) in 18 OECD countries over the period $1984-2003$, and they do not find any permanent effect of immigration.

Estimating an augmented Solow model on data from OECD economies during the period 1960-1985, Dolado et al. (1994) find empirical evidence that corroborates its theoretical result. Their empirical result shows that because of their human capital content, migration inflows have less than half the negative impact of comparable natural population increases. However, more recently, Ortega and Peri (2009) estimate a pseudo-gravity model on 14 OECD countries over the period 1980-2005 and find that immigration does not affect income per capita.

Since migrants take into account job opportunities in their decision to migrate and because the economic conditions in host countries are likely to have a significant impact on migrations policies, some empirical papers examine whether the migration flows respond to host country economic conditions. Particularly, some previews papers examine the Granger causality links between immigration and unemployment using data on individual country (Pope and Withers, 1985 for Australia; Marr and Siklos, 1994 and Islam,

[2]The Martiel Boatlift occurred in 1980 when Fidel Castro permitted that Cubans who wished to leave Cuba from free access to depart from the port of Mariel. Approximately, 125000 Cubans, mostly unskilled workers, migrated to Miami. As a result, the Miami's labour force increased by 7 percent

2007 for Canada). They find no evidence of migration causing higher average rates of unemployment, but find evidence of causation running in the opposite direction. However, Shan et al. (1999) find no Granger-causality between immigration and unemployment, using data from Austria and the New Zealand. Morley (2006) finds evidence of a long-run Granger causality running from per capita GDP to immigration on data for Australia, Canada and the U.S.

Contrary to these previous empirical paper that examine the Granger causality between immigration and unemployment and growth using data on individual country, we employ here panel Granger causality techniques for a panel of OECD countries.

3 Econometric methodology

Three approaches can implemented to test for Granger-causality in a panel framework. The first one is based on the Generalized Method of Moments (GMM) that estimates (homogeneous) panel model by eliminating the fixed effect. However, it does not account for neither heterogeneity nor the cross-sectional dependence[3]. A second approach that deal with heterogeneity was proposed by Hurlin (2008), but its main drawback is that the possible cross-sectional dependence is not taken into account. The third approach developed by Kònya (2006) allows to account for both the cross-sectional dependence and the heterogeneity. It is based on Seemingly Unrelated Regressions (SUR) systems and Wald tests with country specific bootstrap critical values and eanbles to test for Granger-causality on each individual panel member separately, by taking into account the possible contemporaneous correlation across countries. Given its generality, we will implement this last approach in this paper.

The panel causality approach by Kònya (2006) that examine the relationship between Y and X can be studied using the following bivariate finite-order vector autoregressive (VAR) model:

$$\begin{cases} y_{i,t} = \alpha_{1,i} + \sum_{s=1}^{ly_1} \beta_{1,i,s} y_{i,t-s} + \sum_{s=1}^{lx_1} \gamma_{1,i,s} x_{i,t-s} + \varepsilon_{1,i,t} \\ x_{i,t} = \alpha_{2,i} + \sum_{s=1}^{ly_2} \beta_{2,i,s} y_{i,t-s} + \sum_{s=1}^{lx_2} \gamma_{2,i,s} x_{i,t-s} + \varepsilon_{2,i,t} \end{cases} \tag{1}$$

[3]Moreover, as shown by Pesaran et al. (1999) the GMM estimators can lead to inconsistent and misleading estimated parameters unless the slope coefficients are in fact identical.

where the index i ($i = 1, ..., N$) denotes the country, the index t ($t = 1, ..., T$) the period, s the lag, and ly_1, lx_1, ly_2 and lx_2 indicate the lag lengths. The error terms, $\varepsilon_{1,i,t}$ and $\varepsilon_{2,i,t}$ are supposed to be white-noises (i.e. they have zero means, constant variances and are individually serially uncorrelated) and may be correlated with each other for a given country.

In this study, we consider two bivariate systems. In the first bivariate system $System\ 1 : Y = U, X = M$ where U and M denote unemployment rate and net migration rate, respectively. In the second bivariate system $System\ 2 : Y = LGDP, X = M$, where $LGDP$ denotes the natural logarithm of per capita real GDP (or real income).

With respect to system (1) for instance, in country i there is one-way Granger-causality running from X to Y if in the first equation not all $\gamma_{1,i}$'s are zero but in the second all $\beta_{2,i}$'s are zero; there is one-way Granger-causality from Y to X if in the first equation all $\gamma_{1,i}$'s are zero but in the second not all $\beta_{2,i}$'s are zero; there is two-way Granger-causality between Y and X if neither all $\beta_{2,i}$'s nor all $\gamma_{1,i}$'s are zero; and there is no Granger-causality between Y and X if all $\beta_{2,i}$'s and $\gamma_{1,i}$'s are zero.

Since for a given country the two equations in (1) contain the same predetermined, i.e. lagged exogenous and endogenous variables, the OLS estimators of the parameters are consistent and asymptotically efficient. This suggests that the 2N equations in the system can be estimated one-by-one, in any preferred order. Then, instead of N VAR systems in (1), we can consider the following two sets of equations:

$$\begin{cases} y_{1,t} = \alpha_{1,1} + \sum_{s=1}^{ly_1} \beta_{1,1,s} y_{1,t-s} + \sum_{s=1}^{lx_1} \gamma_{1,1,s} x_{1,t-s} + \varepsilon_{1,1,t} \\ y_{2,t} = \alpha_{1,2} + \sum_{s=1}^{ly_1} \beta_{1,2,s} y_{2,t-s} + \sum_{s=1}^{lx_1} \gamma_{1,2,s} x_{2,t-s} + \varepsilon_{1,2,t} \\ \vdots \\ y_{N,t} = \alpha_{1,N} + \sum_{s=1}^{ly_1} \beta_{1,N,s} y_{N,t-s} + \sum_{s=1}^{lx_1} \gamma_{1,N,s} x_{N,t-s} + \varepsilon_{1,N,t} \end{cases} \tag{2}$$

and

$$\begin{cases} x_{1,t} = \alpha_{2,1} + \sum_{s=1}^{ly_2} \beta_{2,1,s} y_{1,t-s} + \sum_{s=1}^{lx_2} \gamma_{2,1,s} x_{1,t-s} + \varepsilon_{2,1,t} \\ x_{2,t} = \alpha_{2,2} + \sum_{s=1}^{ly_2} \beta_{2,2,s} y_{2,t-s} + \sum_{s=1}^{lx_2} \gamma_{2,2,s} x_{2,t-s} + \varepsilon_{2,2,t} \\ \vdots \\ x_{N,t} = \alpha_{2,N} + \sum_{s=1}^{ly_2} \beta_{2,N,s} y_{N,t-s} + \sum_{s=1}^{lx_2} \gamma_{2,N,s} x_{N,t-s} + \varepsilon_{2,N,t} \end{cases} \tag{3}$$

Compared to (1), each equation in (2), and also in (3), has different predetermined variables. The only possible link among individual regressions is contemporaneous correlation within the systems. Therefore, system 2 and 3 must be estimated by (SUR) procedure to take into account contemporaneous correlation within the systems (in presence of contemporaneous correlation the SUR estimator is more efficient than the OLS estimator). Following Kònya (2006), we use country specific bootstrap Wald critical values to implement Granger causality[4].

This procedure has several advantages. Firstly, it does not assume that the panel is homogeneous, so it is possible to test for Granger-causality on each individual panel member separately. However, since contemporaneous correlation is allowed across countries, it makes possible to exploit the extra information provided by the panel data setting. Therefore, country specific bootstrap critical values are generated. Secondly, this approach does not require pretesting for unit roots and cointegration, though it still requires the specification of the lag structure. This is an important feature since the unit-root and cointegration tests in general suffer from low power, and different tests often lead to contradictory outcomes. Thirdly, this panel Granger causality approach allows the researcher to detect for how many and for which members of the panel there exists one-way Granger-causality, two-way Granger-causality or no Granger-causality.

4 Data and Econometric investigation

We use annual data over the period 1980-2005 for 22 OECD countries which are the major migrants-recipients countries. We use net migration, because, as mentioned by OECD, the main sources of information on migration vary across countries, which poses problems for the comparability of available data on inflows and outflows. Since the comparability problems is generally caused by short-term movements, as argued by OECD, taking net migration tends to eliminate these movements that are the main source of non-comparability. Besides, compared to data on inflows and outflows, for the countries that we consider, there are long available series on data on net migration. Net migration rate is measured as total annual arrivals less total departures, divided by the total population. Net migration data include immigrants from OECD countries and do not make a distinction between nationals and foreigners. Entries of persons admitted on a temporary basis are not included

[4]See Appendix for the procedure regarding how bootstrap samples are generated for each country

Table 1: Descriptive statistics

Period	Immigration rate (in thousand)	Unemployment rate (in percent)	GDP per worker
1980-1984	0.9251	6.81	18589
1985-1989	1.4407	7.22	20946
1990-1994	3.4877	8.17	22868
1995-1999	2.8396	7.95	25460
2000-2005	4.5671	6.05	29288

in the satistique. Only permanent and long-term mouvments are considered[5]. Real GDP (in 2000 Purchasing Power Parities) per capita is used to measure real income. The unemployment rate is the ratio of the labour force that actively seeks work but is unable to find work. All variables are taken from OECD Databases. Table 1 reports summary statistics of variables. The figures in Table 1 show that, on average, immigration rate increases from 0.92 per thousand during the period 1980-1984 to 4.57 per thousand during the period 2000-2005. At the same time, GDP per capita increases, while it is difficult to point out a decrease or an increase in unemployment rate.

Since the results from the causality test may be sensitive to the lag structure, determining the optimal lag length(s) is crucial for robustness of findings. For a relatively large panel, equation- and variable-varying lag structure would lead to an increase in the computational burden substantially. To overcome this problem, following Kònya (2006) we allow maximal lags to differ across variables, but to be the same across equations. We estimate the system for each possible pair of ly_1, lx_1, ly_2, and lx_2 respectively by assuming from 1 to 4 lags and then choose the combinations minimizing the Akaike Information Criterion (AIC). The AIC selects the following lags: in the first bivariate system $ly_1 = 2$, $lx_1 = 1$, $ly_2 = 1$, and $lx_2 = 1$; and in the second bivariate system $ly_1 = 2$, $lx_1 = 1$, $ly_2 = 1$ and $lx_2 = 2$.

As mentioned above, testing for the cross-sectional dependence in a panel causality study is crucial for selecting the appropriate estimator. Following Kònya (2006) and Kar et al. (2010), to investigate the existence of cross-sectional dependence we employ three different tests: Lagrange multiplier test statistic for cross-sectional dependence of Breusch and Pagan (1980), and two cross-sectional dependence tests statistic of Pesaran (2004), one based on Lagrange multiplier and the other based on the pair-wise correlation coefficients.

[5]Unauthorised migrants are not taken into account at the time of arrival. They may be included when they are regularised and obtain a long-term status in the country.

Table 2: Results for cross-sectional dependence tests

Model	Test Statistic CD_{BP}	CD_{LM}	CD
System 1 (U)	450.7726***	10.2246***	83.1740***
	(0.000)	(0.000)	(0.000)
System 1 (M)	280.7111*	2.3128	35.8008***
	(0.0141)	(0.0207)	(0.000)
System 2 (LGDP)	709.8659***	22.2789***	131.8569***
	(0.000)	(0.000)	(0.000)
System 2 (M)	308.4733**	3.6044***	12.2688***
	(0.0005)	(0.0003)	(0.000)

CD_{BP}, CD_{LM} and CD denotes the test statistic of Breusch and Pagan Lagrange multiplier statistic for cross-sectional dependence, Pesaran Lagrange multiplier statistic for cross-sectional dependence and Pesaran cross-sectional dependence statistic based on the pair-wise correlation coefficients, respectively. Under the null hypothesis of no cross-sectional dependence, CD_{BP} follows a chi-square distribution with $N(N-1)/2$ degrees of freedom, CD_{LM} and CD follow standard normal distribution . ***, ** and * indicate rejection of the null hypothesis at 1 and 5 and 10 percent level of significance, respectively.

The Lagrange multiplier test statistic for cross-sectional dependence of Breusch and Pagan (1980) is given by:

$$CD_{BP} = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^2 \tag{4}$$

where $\hat{\rho}_{ij}$ is the estimated correlation coefficient among the residuals obtained from individual OLS estimations. Under the null hypothesis of no cross-sectional dependence with a fixed N and large T, CD_{BP} asymptotically follows a chi-squared distribution with $N(N-1)/2$ degrees of freedom (Greene (2003), p.350).

Since, BP test has a drawback when N is large Pesaran (2004) proposes another Lagrange multiplier (CD_{LM}) statistic for cross-sectional dependence that does nor suffer from this problem. The CD_{LM} statistic is given as follows:

$$CD_{LM} = \sqrt{\frac{1}{N(N-1)}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(T\hat{\rho}_{ij}^2 - 1)} \tag{5}$$

Under the null hypothesis of no cross-sectional dependence with the first $T \to \infty$ and then $N \to \infty$, CD_{LM} asymptotically follows a normal distribution. However, this test is likely to exhibit substantial size distortions when N is large relative to T. Pesaran (2004) proposes a new test for cross-sectional dependence (CD) that can be used where N is large and T is small. This test is based on the pair-wise correlation coefficients rather than their squares used in the LM test. The CD statistic is given by:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij} \tag{6}$$

Under the null hypothesis of no cross-sectional dependence with the $T \to \infty$ and then $N \to \infty$ in any order, CD asymptotically follows a normal distribution. Pesaran (2004) show that the CD test is likely to have good small sample properties (for both N and T small).

Table 2 reports the results of these cross-sectional dependence tests. The results in 2 show that all the three tests reject the null of no cross-sectional dependence across the members of the panel at 5% level of significance, implying that the SUR method is appropriate rather than a country-by-country OLS estimation. The cross-sectional dependence tests confirm that a strong economic links exist between OECD countries members.

5 Results and Discussions

Table 3-6 report the results of Granger causality. Notice that the bootstrap critical values are substantially higher than the chi-square critical values usually applied with the Wald test, and that they vary considerably from a country to another and across tables[6]. The results of causality tests from immigration to unemployment and from unemployment to immigration are displayed in Table 3 and Table 4, respectively. The results of causality form immigration to GDP and from GDP to immigration are displayed in Table 5 and Table 6, respectively. In the tables 3-6, the column 'estimated coefficient' represents the estimated coefficient of x_{t-1} (y_{t-1}) in the equation testing from Granger causality from X to Y (Y to X).

[6]The chi-square critical values for one degree of freedom, i.e. for Wald tests with one restriction, are 6.6349, 3.8415, 2.7055 for 1%, 5% and 10%, respectively.

Table 3: Granger causality tests immigration to unemployment

Country	Estimated coefficient	Test Stat.	Bootstrap critical values 1%	5%	10%
Australia	0.1938	13.0198	287.7363	138.7766	90.6493
Austria	0.0234	5.6799	286.6355	125.8565	80.5467
Belgium	-0.1245	3.6805	175.4215	77.6084	50.1208
Canada	0.0059	0.0140	274.5667	139.4946	91.9954
Denmark	-0.2288	5.7721	337.5072	140.8359	90.8154
Finland	1.2062	52.9716	316.3091	150.2173	96.7384
France	-0.0292	0.0222	173.9483	81.8138	52.8704
Germany	0.0173	1.9601	295.8401	139.7354	93.7130
Greece	0.0821	9.0246	230.2833	109.3694	72.4079
Iceland	0.0610	15.7417	286.9114	132.6577	86.1520
Ireland	-0.1138	23.1385	342.9583	154.8923	103.2070
Italy	-0.0583	11.3306	207.7941	85.4204	54.6998
Luxembourg	0.0072	2.4710	331.8680	159.0345	106.0899
Netherlands	0.1967	11.7020	230.3935	99.0387	62.2805
New Zealand	-0.0130	0.4398	248.4385	112.1155	75.7471
Norway	0.2627	58.7593	303.4181	134.9851	85.3963
Portugal	0.0218	0.6693	156.7490	75.7666	49.2947
Spain	-0.2794	57.3525	241.2615	110.0584	72.6988
Sweden	0.0373	1.2791	404.1338	196.2905	125.7544
Switzerland	0.0767	35.3416	296.1276	143.5848	92.3061
United Kingdom	-0.1357	3.8144	263.5924	119.9834	77.9560
United States	-0.1908	7.7114	284.1708	132.2164	83.6499

Note: H_0 : immigration does not cause unemployment. The column "Estimated coefficient" denotes the estimated coefficient of lag of immigration rate in the equation testing Granger causality from immigration to unemployment rate. ***, **, and * indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

Table 4: Granger causality tests unemployment to immigration

Country	Estimated coefficient	Test Stat.	Bootstrap critical values 1%	5%	10%
Australia	-0.3315	8.2290	306.8964	143.4189	93.5239
Austria	0.0892	0.0347	326.9468	141.4868	90.3277
Belgium	-0.0858	13.4350	206.6685	90.3308	58.6337
Canada	-0.2170	6.5177	292.1500	125.6811	80.9669
Denmark	0.1012	4.8414	350.6973	150.9016	100.5670
Finland	-0.0378	9.5450	273.6004	130.8957	85.1077
France	-0.0540	16.1243	290.4957	147.3383	99.4058
Germany	-0.0490	0.1187	294.3776	144.2217	95.1106
Greece	-0.0161	0.0375	341.1858	171.5095	111.4617
Iceland	-0.2756	1.1717	218.2504	100.4272	64.8144
Ireland	-0.3785	5.1142	244.2332	107.9090	69.3826
Italy	-0.1845	1.7309	369.5746	169.3226	113.8005
Luxembourg	1.4298	5.7080	207.6518	99.2973	64.7285
Netherlands	0.1746	16.5221	236.9243	124.0193	81.6781
New Zealand	0.2662	1.7910	290.4320	134.6834	85.8611
Norway	0.0597	0.3610	264.9229	119.5181	74.3819
Portugal	-0.6033	122.3191*	334.0911	146.9617	97.5169
Spain	-0.1282	6.1913	132.1068	59.5167	38.1426
Sweden	-0.0153	0.1089	232.5700	108.9333	69.3073
Switzerland	-0.5030	14.4276	241.6980	116.7093	76.3445
United Kingdom	-0.0364	0.6224	221.8538	102.3553	66.4853
United States	-0.0649	4.0023	314.9698	153.4151	100.2002

Note: H_0 : unemployment does not cause immigration. The column "Estimated coefficient" denotes the coefficient of the lag of the immigration rate in the equation testing for Granger causality from unemployment to immigration. ***, **, and * indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

Table 5: Granger causality tests immigration to GDP

Country	Estimated coefficient	Test Stat.	Bootstrap critical values		
			1%	5%	10%
Australia	-0.0062	145.2363	642.1363	300.2588	184.0594
Austria	-0.0014	20.1850	509.7105	216.5362	133.1134
Belgium	-0.0030	18.2444	681.2106	284.3846	186.9683
Canada	-0.0071	107.2464	908.8519	393.7506	258.2969
Denmark	-0.0000	0.0018	651.5292	255.4873	155.2668
Finland	-0.0223	136.2913	603.1720	268.2465	169.2409
France	-0.0207	103.0732	585.3197	304.6188	206.4012
Germany	0.0004	7.8763	558.5621	269.2568	182.6525
Greece	-0.0007	0.6512	185.0076	83.9402	53.1138
Iceland	-0.0041	25.0658	528.0840	232.1546	141.7218
Ireland	-0.0016	23.6291	531.9374	223.8201	144.6197
Italy	-0.0004	1.1934	524.0714	244.2464	159.6062
Luxembourg	0.0001	0.0160	475.9581	197.6779	119.3652
Netherlands	-0.0028	24.4681	609.2427	270.3311	176.1551
New Zealand	-0.0005	1.9322	528.0105	229.6578	144.5666
Norway	-0.0036	38.4940	883.3209	343.9916	215.0718
Portugal	-0.0010	1.0132	472.0737	216.6576	137.7028
Spain	-0.0000	0.0004	517.1960	249.8073	168.2989
Sweden	-0.0021	7.7808	704.4112	310.1129	197.6469
Switzerland	-0.0026	28.3606	491.3078	230.0392	150.7396
United Kingdom	-0.0039	24.8869	770.9085	344.2256	229.1871
United States	-0.0016	1.4538	638.4730	305.0717	199.0662

Note: H_0 : immigration does not cause GDP. The column "Estimated coefficient" denotes the coefficient of the lag of the immigration rate in the equation testing for Granger causality from immigration rate to LOG(GDP). ***, **, and * indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

Table 6: Granger causality tests GDP to immigration

Country	Estimated coefficient	Test Stat.	Bootstrap critical values 1%	5%	10%
Australia	0.5966	0.2133	44.1132	21.2758	14.2802
Austria	4.1763	3.0485	69.4796	31.4398	19.9934
Belgium	2.2344	7.9633	165.3051	81.3064	53.7078
Canada	4.7688	16.5011	67.4497	31.3532	20.3437
Denmark	0.9893	0.5960	64.1267	29.2654	19.2426
Finland	0.7857	4.5312	96.3905	45.0952	28.9216
France	0.3803	14.5200*	38.4159	19.2248	12.9537
Germany	-1.9891	0.5180	103.0069	50.1292	32.2102
Greece	-1.6919	1.8655	190.9693	90.9634	60.1493
Iceland	19.4588	72.6350**	78.6381	34.7857	21.7824
Ireland	12.0384	37.9026	229.9758	104.5681	68.5805
Italy	5.5991	7.6469	42.8646	21.7309	14.0878
Luxembourg	2.1905	1.8097	77.9690	36.2650	22.8619
Netherlands	-1.3450	2.8127	57.4609	25.3127	16.4470
New Zealand	14.6758	8.0079	70.7573	32.1478	20.4502
Norway	4.9385	43.0513***	42.8830	21.1842	13.4986
Portugal	3.2272	19.6184	175.9970	80.2091	51.6689
Spain	4.7815	13.5030	243.5550	128.0488	89.6999
Sweden	1.4345	0.9856	66.7698	29.7692	19.2975
Switzerland	3.9219	1.3726	93.4584	43.4481	27.4950
United Kingdom	3.9982	34.5706**	66.1783	29.5176	18.6249
United States	0.3443	0.4280	93.8299	42.5891	27.7797

Note: H_0 : GDP does not cause immigration. The column "Estimated coefficient" denotes the coefficient of the lag of the immigration rate in the equation testing for Granger causality from LOG(GDP) to immigration rate. ***, **, and * indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

The results in Table 3 show that, in any country, there is no causality from immigration to unemployment. Table 4 shows that, for only Portugal, there is a significant (at the 10% level of significance) negative causality running from unemployment to immigration, while for the other countries there is no significant causality running from unemployment to immigration.

The results in Table 5 suggest that, in any country, there is no significant causality running from immigration to GDP. Table 6 shows that in four countries (France, Iceland, Norway and United Kingdom) there is a positive significant causality running from GDP to immigration; while in the other countries there is no significant causality running from GDP to immigration. There is a positive causality running from GDP to immigration at 1 percent level of significance for Norway, 5 percent level of significance for Iceland and United Kingdom Norway and 10 percent level of significance for France.

Our study shows evidence that the interaction between immigration and host economic activity depends on the host country that we consider. Our findings suggest that, only in Portugal, immigration inflow negatively responds to unemployment, while in any country, unemployment does not respond to immigration inflow. Our results also find that, in four countries (France, Iceland, Norway and United Kingdom), immigration inflow positively responds to economic growth, while in any country, economic growth does not respond to immigration inflow.

The fact that immigration does not impact host economic variables can be explained by the evidence that the human capital content of migration inflow is high in order to compensate the negative effects of immigration on output (Dolado et al., 1994). As a result there will be no negative impact of immigration on growth and employment. The findings from this paper support the results from some previews studies (Simon et al., 1993; Dolado et al., 1994; Marr and Siklos, 1994; Pischke and Velling, 1997; Dustmann et al., 2005 Ortega and Peri (2009)).

The findings of causality from immigration to host economic variables can be related to the characteristics of countries immigration policies. For example, the negative influence of unemployment on immigration in Portugal can be explained as follow. Portugal, a country with long history of expatiation, has become significant immigration country recently. Foremost, immigration flows to Portugal were mainly from its former colonies (Brazil and Portuguese-Speaking African Countries (PALOP)). Since the 1990s, a large proportion of "new" immigrants with economic reason come from Europe and Asia. The needs of Portuguese employers play a significant role in the recruitment process of the newly arrived immigrants. Accordingly, the Portuguese government adjusts its migration policy according to the requirement of the labour market. Finally, immigrants, both Portuguese nationals and foreign, are more likely to immigrate to a third European country when the labour market situation is less favorable.

For the four countries (France, Iceland, Norway and United Kingdom), the explanations of positive impact of growth on immigration are as follow. The positive influence of the economic growth on migration flows may be related to the family reunification requirements. In France, family component is the main channel of entry for long-term immigrants. In order to bring their families, immigrants have to satisfy a minimum level of income. During a period of higher growth, immigrants have great possibility to satisfy this minimum level of income criteria. Moreover, economic migration to France mainly includes immigrants from European countries (such as Portugal) that are attracted by better economic prospects.

Norway and Iceland are two small countries with high incomes and high demand for labour. So, the main attraction for immigrants to these two countries is the high standard of living. A large percentage of labour immigration is from Nordic neighbors and OECD countries. The booming economy and the increased demand of labour in Norway and Island led authorities to admit economic immigrants during the last years.

Finally, the explanation of the result for the United-Kingdom can be explained by the fact that the immigrants to the United Kingdom are more attracted by the prospect of higher wages produced by the greater economic growth. In the United Kingdom, labour migration represents a sizable percentage of total inflows (44 percent in 2005)[7]. If family members accompanying workers are taken into account, the percentage of economic migration is around 60 percent in 2005. The inflow of labour migration increased from 124 thousands on average per year in the 1980s to 200 thousands in the 1990s. From 2000 to 2005, the labour migration inflows reached 333 thousand per year on average.

6 Concluding Remarks

This paper examines the causality between immigration and the economic conditions of host countries (unemployment and growth). We employ the panel Granger causality testing approach recently developed by Kònya (2006) that is based on SUR systems and Wald tests with country specific bootstrap critical values. We use annual data over the period 1980-2005 for 22 OECD countries which are the major migrants-recipients countries.

[7]The work category combines two IPS reasons for migration: "definite job" and "looking for work". Authors' calculation is based on Office for National Statistics (2008, 2009).

Our study provides evidence that the interaction between immigration and host economic activity depends on the host country. On the one hand, our finding suggests that, only in Portugal, unemployment negatively Granger causes immigration inflow, while in any country, immigration inflow does not Grange cause unemployment. On the other hand, our results find that, in four countries (France, Iceland, Norway and United Kingdom), economic growth positively Granger causes immigration inflow, while in any country, immigration inflow does not Granger cause economic growth.

Our results confirm that the levels of immigration tend to be highly regulated (or migrants are selected contingent on theirs skills). Because of high skill of migrants, the human capital content of a migration inflow is high in order to compensate the negative effects of immigration on economic growth (Dolado et al., 1994). As a result there will be no negative effect of immigration on host economic growth and employment.

In order to tackle the problem of aging population, many OECD countries see immigration as a potential solution to compensate for the labour shortage. Our results indicate that immigration flows do not harm the employment prospects of residents. Hence, OECD countries may receive more migrants, without fearing about a potential negative impact on growth and employment.

Appendix: The bootstrap procedure

The procedure to generate bootstrap samples and country specific critical values (in the test of no causality from X to Y) consists of the following five steps (Kònya, 2006)

1st step: Implement an estimation of (2) under the null hypothesis of no-causality from X to Y by (i.e. imposing $\gamma_{1,i,s} = 0$ the for all i and s) and get the corresponding residuals:

$$e_{H_0,i,t} = y_{i,t} - \hat{\alpha}_{i,1} + \sum_{s=1}^{ly_1} \hat{\beta}_{1,i,s} y_{i,t-s}$$

From these residuals, build the $N \times T$ $[e_{H_0,i,t}]$ matrix.

2nd step: In order to preserve the contemporaneous dependence between error terms in (2), randomly select a full column from $[e_{H_0,i,t}]$ matrix at a time (i.e do not draw the residuals for each country one-by-one); and denote the selected bootstrap residuals as $\left[e^*_{H_0,i,t}\right]$ where $t = 1, ..., T^*$ and T^* can be greater than T.

3rd step: Build the bootstrap sample of Y under the hypothesis of no-causality from X to Y, i.e. using the following formula:

$$y^*_{i,t} = \hat{\alpha}_{i,1} + \sum_{s=1}^{ly_1} \hat{\beta}_{1,i,s} y^*_{i,t-s} + e^*_{H_0,i,t}$$

4th step: Replace $y_{i,t}$ by $y^*_{i,t}$, estimate (2) without any parameter restrictions and then implement the Wald test for each country to test for the no-causality null hypothesis.

5th step: Develop the empirical distributions of the Wald test statistics by repeating (10,000 replications) the steps 2-4 many times and build the bootstrap critical values.

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