Immigration, Unemployment and Growth: Empirical Evidence from Greece

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Abstract: This paper applies cointegration analysis and Granger non-causality tests in order to identify the direction of causality between migration in Greece and two macroeconomic variables: real per capita GDP and unemployment. We use annual data for the period 1980-2011. The data are drawn from the International Migration Statistics (OECD) and the International Monetary Fund Database (IMF). Our results provide empirical evidence that the growth rates of GDP and unemployment cause migration in Granger's sense. On the contrary, evidence of reverse causality is not established.

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1. Introduction

The collapse of communist regimes in Eastern Europe in 1989 has led to a huge influx of immigrants into Greece which had previously been an exporter of immigrants. Today, it is considered as one of the most important immigration countries in Europe. Its border with Turkey is the main route for undocumented immigrants[3] -from the Middle East, Africa and Southern Asia- who seek entry into European Union. A considerable number of the illegal migrants however are trapped in Greece[4] due to tight border controls in the Northern and Western Europe.

According to the 2001 Census of population, immigrants from Albania (57.5%), Bulgaria (4.6%), Georgia (3.0%), Romania (2.6%) and Russia (2.3%) are the majority among the immigrant population (Cholezas and Tsakloglou, 2006). Moreover, the foreign population tends to be concentrated in large urban centers. Attiki[5] (53.6%) and Central Macedonia (13.6%) appear to be the regions where the concentration of immigrants is the highest, whereas the concentration is lowest in Northen Aegean (0.8%) and Western Macedonia (0.7%).

The current economic recession, the severe fall in output due to it and the subsequent rise in unemployment have fueled fears that immigrants pose a threat to the Greek society and the economy in particular. Consequently, this situation has fostered the creation and success of anti-immigrant political parties that have linked unemployment to immigration.

Consequently, the main objective of this paper is to examine the causal relationship between immigration and two macroeconomic variables: (i) per capita GDP and (ii) unemployment. On the other hand, it is important to highlight that "pull" factors -such as higher income and better employment opportunities- in the host country have a significant impact on the migration decision (see e.g. Zimmermann, 1996). Given that the Greek governments have been

[3] According to the Hellenic Migration Policy Institute (IMEPO) the number of illegal migrants is estimated at about 400,000. The total number of immigrants (legal and illegal) is estimated at about one million (about ten percent of total population in Greece).

[4] Moreover, those who manage to reach Western Europe are obligated by Dublin II regulation to appeal for asylum in their first country of arrival. Hence, they are forced to return back to Greece.

[5] Attiki covers the city of Athens, the capital of Greece, and the wider Athens area.

unsuccessful in controlling the borders, Greece is an ideal country in Europe to investigate the reverse causal relation running from the host country economic conditions (GDP, unemployment) to migration. To this end, we proceed by applying cointegration analysis and Granger non-causality tests for the period 1980-2011. These tests allow us to investigate the direction of causality in the long and short run between the variables under consideration.

Although there is a large number of empirical studies examining the causal relationship between immigration, unemployment and economic growth for various countries, to the best of our knoweledge, the only study that employs data for Greece is that of Boubtane et al. (2011) which is based on a panel of 22 OECD countries for the period 1980-2005. Our paper differs form the study of Boubtane et al. in several important ways. Firstly, in our analysis we consider migration as the number of the stock of immigrants divided by the number of total population, while Boubtane et al. use net migration flows. Albeit quite a few empirical migration models employ net migration instead of the stock of immigrants, it is shown by Brucker and Schroder (2011) that such models may be misspecified because the number of migrants varies with income differences between the host and the home country, while net migration does not. Secondly, Boubtane et al. put aside the aspect of cointegration. They use the method of Konya (2006) that enables to test for Granger causality on each individual panel member separately. On the contrary, we implement the Johansen (1988), the Autoregressive Distributed Lag model (ARDL) developed by Pesaran et al. (2001) and the Gregory and Hansen (1996) cointegration approach. By using three different estimation methods and comparing their results we could safely infer about the existence of a long run relationship. Thirdly, utilizing the cointegration results we employ an Error Correction Model to determine the direction of causation between the variables. The ECM does not only provide an indication of the direction of causality, but also enables us to distinguish between short-run and long-run Granger causality.

Our main empirical findings are as follows. First, Cointegration tests indicate the existence of long run relationship between the variables analyzed in this paper. Second, the causality tests indicate that there is a unidirectional causal relationship running from GDP and unemployment to immigration in the long but not in the short run. This result indicates that immigration does not Granger cause GDP and unemployment. On the other hand, we may conclude that immigration appears to be closely related to economic conditions in Greece.

The remainder of this paper is organized as follows: In the next two Sections we present the theoretical considerations and a review of the empirical literature. Section 4 describes the data used in this study. In Section 5 we present the methodology and discuss the cointegration results. Section 6 presents the results of the Granger causality tests. Finally, section 7 concludes the paper.

2. Theoretical Considerations

There are primarily two frameworks for analyzing the effects of immigration in the host economy: labor market models and trade models. According to Gaston and Nelson (2000) the difference between the basic labor model and the basic trade model is dimensionality. More precisely, labor economists prefer a one final good model and trade economists prefer a model with multiple final goods[6].

The simple neoclassical supply and demand model of the labor market[7], predicts that immigration would lower the wage of native workers. Furthermore, if natives' labor supply is somewhat elastic, migration can then generate some (voluntary) unemployment on native workers whose wages have fallen below their reservation wage (see e.g. Altonji and Card, 1991; Dustmann et al. 2005). In addition, immigration is also expected to transfer income from the

[6] In the present section, we prefer to use models that assume a perfectly competitive market in order to explain the effects of immigration because of their clear cut implications. If labor market rigidities are introduced, the impact of immigration is generally ambiguous (see e.g. Schmidt et al., 1994; Fuest and Thum, 2000).

[7] The model presented in the text is based on the assumptions that: (i) labor is homogeneous, (ii) immigrants are perfect substitutes for natives, (iii) immigrants do no affect the labor demand and (iv) capital and labor are complementary factors.

native workers to the owners of capital. Overall, migration generates an increase in aggregate (and per capita) income that is called by Borjas[8] (1995) the “immigration surplus[9]”.

However, it is interesting to note that the model presented above abstracts from the effects of immigration on the labor demand. In the real word, immigrants do not only add to the stock of labor, but they also consume local goods and services, increasing the demand for labor (see e.g. Bodvarsson et al., 2008). Hence, in this case, it is expected that the migrants’ demand effect would mitigate the initial adverse effects of migration in a long-run period. Consequently, if wages would be unaffected the “immigration surplus” would equal to zero.

On the other hand, trade economists often analyze the effects of immigration within the context of the Heckscher-Ohlin model (see e.g. Friedberg and Hunt, 1995; Gaston and Nelson, 2000). If the classical assumptions of the H-O model are fulfilled, the economy adjusts to immigration through changes in output mix. This is the well known Rybczinski theorem. Under these conditions, no effects are expected on employment and per capita income[10].

Finally, a strand of the literature analyzes the effects of immigration using macroeconomic models. The neoclassical Solow-Swan model implies that migration induces a reduction in per capita capital, and moves the economy to a new steady state with lower per capita income (see e.g. Jones, 1998; Barro and Sala-i-Martin, 2004). Similarly, Dolado et al (1994) use a Solow model augmented by human capital to analyze the impact of immigration. Their theoretical model implies that the negative effects on per capita income are lower in countries where immigrants are more skilled. Moreover, Kemnitz (2001) using an AK model shows that immigration reduces natives’ income if immigrants possess on average less capital than natives. Finally, according to Gonzalez-Gomez and Giraldez (2011), the admission of immigrants, who are eager to accept

[8] According to his estimations the economic gains from immigration are relatively small: about $7 billion per year or less than $30 per native-born person in the United States.

[9] If labor heterogeneity is assumed (i.e. skilled and unskilled labor), the immigration surplus is positive as long as the skill composition of immigrants differs from that of native workers. On the contrary, if migrants’ skill composition resembles that of natives, wages would be unaffected by immigration and the immigration surplus would equal zero. See e.g. Altonji and Card (1991) and Dustmann et al. (2005) for more technical details.

[10] However, a positive immigration surplus emerges in a more realistic model of trade without factor price equalization (i.e. more commodities than factors). The immigration surplus is also positive in the context of the Specific Factors model and negative in the Ricardian Trade model (see Trefler, 1997).

lower wages, impedes structural changes and technological development and contributes to slow growth rates. The rationale is that due to the existence of immigrants, firms are not forced to invest in technology. Instead, they use their savings to hire cheap foreign labor force.

3. Previous findings

Beginning with Grossmann's (1982) seminal study, most of the empirical literature analyzes the effects of immigration by regressing various measures of economic outcomes of natives on the share of immigrants across local labor markets[11] (see e.g. Card, 1990; Altonji and Card, 1991; Pischke and Velling, 1997; Dustmann et al, 2005). This strand of the literature usually concludes that immigration do not dramatically affect the employment opportunities of natives[12]. However, this approach has been critized (see e.g. Friedberg and Hunt, 1995; Borjas, 2003) for yielding biased towards to zero results because: (i) immigrants tend to go into booming labor markets (simultaneity bias), (ii) native internal migration and (iii) factor price equalization across regions within the host country.

Hence, a second strand of the literature uses time-series data at the national level to avoid such biases towards zero (see e.g. Pope and Withers, 1993; Marr and Siklos 1994; Feridun, 2004; Molrey, 2006; Boubtane et al., 2011). These studies use cointegration analysis and Granger causality tests to identify the direction of causality between migration unemployment and GDP. Most of these studies find evidence of unidirectional causality running from unemployment and GDP to immigration, but not vice versa. As discussed in the introduction, the only study that employs data for Greece is that of Boubtane et al. (2011). Using a different estimation strategy, the authors fail to reject the null hypothesis of no Granger causality between the variable of net immigration and the variables of unemployment and GDP.

[11] This approach is usually called the "spatial correlations" approach (see e.g. Borjas, 1999).
[12] See the excellent reviews of the literature by Borjas (1994); Friedberg and Hunt (1995); Okkerse (2008)

4. Data

We proceed our analysis by applying the Granger causality test in order to study the causal relationship between immigration and two macroeconomic indicators in Greece. Immigration (IMM) is measured as the ratio of the stock of immigrants to total population. The macroeconomic variables used in the model are the unemployment rate (*UNE*) and the real per capita GDP (*GDP*). All variables are expressed in natural logarithms. The data are annual from 1980-2011. Data on migration come from the International Migration Database (OECD), while data on macroeconomic variables come from the International Monetary Fund Database (IMF Data and Statistics). In Table 1 we present the variables employed in our analysis as well as some descriptive statistics. As can be seen, immigration raises from 1.17 percent during the 1980-1990 period to 5.75 percent during the period 2001-2010. At the same time, both per capita GDP and unemployment increase.

Table 1. Descriptive Statistics

Period	*IMM*	*UNE*	*GDP*
1980-1990	1.17	6.44	10254
1991-2000	1.82	9.77	11196
2001-2010	5.75	10.47	14753

Notes: (i) *IMM* is the ratio of the stock of immigrants to total population. (ii) *UNE* is the number of unemployed individuals divided by all individuals currently in the labor force. (iii) *GDP* is the per capita Gross Domestic Product in constant prices.

5. Methodology and Empirical Results

When dealing with time series, a main concern is stationarity. In order to avoid spurious results in the causality tests, it is necessary to investigate the order of integration of the variables under consideration. So in the first step of the empirical analysis we employ the conventional Phillips-Perron (1988) unit root tests for all variables. Nevertheless, in the presence of a structural break the P-P tests are biased towards the non-rejection of the null hypothesis (Zivot and

Andrews, 1992). Hence, we also apply the Zivot and Andrews (1992) unit root test with an endogenously determined break point. The results of the unit root tests are reported in Table 2. As it is evident, both tests indicate that immigration is integrated of order one, I(1). On the other hand, unemployment and GDP are integrated of order two, I(2).

Table 2. Results of the unit root tests

	Phillips-Perron		Zivot-Andrews	
Variable	t-statistic Model with Constant	t-statistic Model with Constant and Trend	t-statistic Model with Constant and Trend	Break
IMM	5.700 (9)	1.759 (9)	-3.320 (0)	1996
UNE	-0.466 (0)	-1.313 (0)	-2.810 (1)	1998
GDP	-0.672 (4)	-2.074 (3)	-1.708 (1)	1986
ΔIMM	-5.217* (3)	-9.449* (4)	-9.724* (0)	1998
ΔUNE	-1.114 (1)	-0.597 (0)	-3.540 (0)	2006
Δ^2UNE	-4.456* (1)	-4.985* (0)	-6.521* (0)	2005
ΔGDP	-1.978 (4)	-1.362 (4)	-2.693 (2)	2006
Δ^2GDP	-5.957* (4)	-6.748* (4)	-8.343* (1)	1996

Notes: Optimal lag determination according to BIC. * indicates the rejection of the unit root null hypothesis at the 1% significant level.

In the second step of our analysis, we also test for cointegration between the variables under consideration. Since we have found different orders of integration, we follow Gonzalez-Gomez and Giraldez (2011) and identify the possible long run relationships between the I(1) *IMM* variable and the first difference (growth rate) of the I(2) *GDP* and *UNE* variables[13]. To this end, we proceed by employing the procedure proposed and developed by Johansen (1988) and Johansen and Juselius (1990). The Johansen cointegration approach entails the maximum likelihood estimation of the following Vector Error Correction Model (VECM):

$$\Delta Z_t = \Pi Z_{\tau-1} + \sum_{\iota=1}^{r-1} \Gamma_i \Delta Z_{\tau-\iota} + BX_\tau + u_t \quad (1)$$

Where Z_t is a vector containing the endogenous variables, Π is a $v \times v$ matrix which determines the number of co-integrating relationships and Γ_i is is a $v \times v$ coefficient matrix. In order to test

[13] The first difference of an I(2) variable is I(1).

for the absence of long-run relationship between the variables under consideration we employ the maximum eigenvalue (λ_{max}) and the trace (λ_{trace}) statistic.

Table 3 summarizes the results of the Johansen likelihood ratio tests for three different cointegration specifications[14]. As can be seen, when Model A and Model B are employed, the test statistics indicate that the null hypothesis of no cointegration cannot be rejected at the 5% significant level. On the other hand, the maximum eigenvalue and trace test statistics indicate that the null hypothesis is rejected when Model C is employed.

Table 3. Johansen test statistic results for the cointegration of immigration

	Model A		Model B		Model C	
GDP	λ_{trace}	λ_{max}	λ_{trace}	λ_{max}	λ_{trace}	λ_{max}
$H_0: r = 0$	12.64	10.97	10.17	9.48	28.95*	22.47*
$H_0: r \leq 1$	1.67	1.67	0.69	0.69	6.47	6.47
	Model A		Model B		Model C	
UNE	λ_{trace}	λ_{max}	λ_{trace}	λ_{max}	λ_{trace}	λ_{max}
$H_0: r = 0$	17.94	15.11	15.17	14.08	30.07*	23.73*
$H_0: r \leq 1$	2.82	2.82	3.84	3.84	6.33	6.33

Notes: Optimal lag determination according to BIC. * indicates the rejection of the null hypothesis at the 5% significant level.

For robustness purposes, we also apply the Autoregressive Lag Distributed Model (ARDL) cointegration test developed by Pesaran et al. (2001). The ARDL methodology is considered relatively more efficient in small samples (as is the case in this study) than the cointegration approach of Johansen (see e.g. Pesaran and Shin, 1999). The ARDL bounds test involves the estimation of the following VEC model:

$$\Delta IMM_t = a + \beta_1 IMM_{\tau-1} + \beta_1 \Delta GDP_{\tau-1} + \sum_{\iota=1}^{\rho-1} \gamma_{1i} \Delta IMM_{t-1} + \sum_{i=0}^{q-1} \gamma_{2i} \Delta\Delta GDP_{t-i} + u_t \tag{2}$$

$$\Delta IMM_t = a + \beta_1 IMM_{\tau-1} + \beta_2 \Delta UNE_{\tau-1} + \sum_{\iota=1}^{\rho-1} \gamma_{1i} \Delta IMM_{t-1} + \sum_{i=0}^{q-1} \gamma_{2i} \Delta\Delta UNE_{t-i} + e_t \tag{3}$$

[14] Model A does not allow for any linear trends in the data, but allows for a constant in the cointegrating equation. In Model B, there are no linear trends in the data. However, an intercept is included in both the cointegrating equation and the VAR model. Model C allows for an intercept and linear trend in the cointegrating equation and a constant in the VAR.

To test for the absence of cointegration we employ an F-test for the joint null hypothesis $\beta_1 = \beta_2 = 0$. Afterwards, the F-statistic is compared with two asymptotic critical values bounds provided by Pesaran et al. (2001), when the independent variables are I(d) (where $0 \leq d \leq 1$): a lower value assuming the regressors are I(0) and an upper value assuming I(1) regressors. If the test statistic exceeds the upper bound critical values, then we establish the existence of a stable long run relationship. If it is below the lower critical value bound there is no evidence of a long run relationship, and if it lies between the critical value bounds the test is inconclusive.

The bounds test results are presented in Table 4. The optimal lag length is selected according to Schwarz Bayesian Criterion, while the Lagrange Multiplier (LM) statistic ensures the absence of serial correlated residuals. As can be identified, the F-statistic for *GDP* lies above the 0.10 upper critical bound. Hence, according to the ARDL results we can conclude that there is a stable long-run between immigration and the (growth rate of) per capita GDP. As far as the long run relationship between migration and unemployment is concerned, our empirical findings indicate that the computed F-statistic lies between the upper and lower bound. Hence, we characterize this result as inconclusive.

Table 4. ARDL Bounds test

Variable	Lags	LM	F-statistic	Outcome
GDP	2	0.204	5.234[a]	Cointegration
UNE	1	0.256	4.598	Inconclusive

Notes: Optimal lag determination according to BIC. [a] indicates the rejection of the null hypothesis at the 10% significant level. LM is serial correlation test. Asymptotic critical values are obtained from Table CI(iii) Case III: unrestricted intercept and no trend

Usually, the existence of a structural break in the data, that is ignored from the cointegration test, can produce spurious rejections of the null hypothesis (see e.g. Phillips, 1986). The traditional cointegration tests however do not account for such structural changes. In order to tackle this problem we employ the Gregory and Hansen (1996) approach. GH developed a residual-based technique to test the null hypothesis (no cointegration) against the alternative of cointegration in the presence of a structural break in: (i) the constant term (C), (ii) the constant and the trend (C/T) and (iii) in the constant and the slope (C/S). In this approach the break is unknown and is endogenously determined by the smallest value of the modified PP (Z_t, Z_a) and ADF statistics. The results are presented in Table 5. When the cointegration between *IMM* and *GDP* is considered, we observe that the ADF, Z_t and Z_a statistics estimate the same break dates. On the other hand, when the cointegration between *IMM* and *GDP* is considered, the ADF suggests different break dates suggested than those suggested by the Z_t and Z_a statistics. Considering that the Z_t is the best in terms of power (see Gregory and Hansen, 1996), the reported evidence suggests that there exists long-run relationship between *GDP* and *IMM* in models C/T and C/S. On the other hand, our results provide empirical evidence in favor of cointegration between *UNE* and *IMM* in the case where the model C/T is employed.

Table 5. Gregory-Hansen cointegration tests

		ADF		Z_t		Z_a	
	Model	Test-statistic	Break	Test-statistic	Break	Test-statistic	Break
$GDP \rightarrow IMM$	C	-3.92	1997	-3.99	1997	-21.55	1997
	C/T	-6.40***	1997	-6.71***	1997	-31.27	1997
	C/S	-4.51	1997	-4.76*	1997	-25.06	1997
$UNE \rightarrow IMM$	C	-3.57	1998	-3.34	1997	-16.57	1997
	C/T	-4.63	1998	-6.77***	1999	-31.63	1999
	C/S	-4.02	1997	-4.09	1997	-21.79	1997

Notes: Optimal lag determination according to BIC. * indicates the rejection of the null hypothesis at the 10% significant level. *** indicates the rejection of the null hypothesis at the 1% significant level.

6. Granger Causality Tests

Cointegration implies that Granger causality must exist in at least one direction between two variables but it does not indicate the direction of the causal relationship. In this section, we test for Granger (1969, 1988) causality by employing a VECM where we include the lagged error correction term from the long-run cointegration equation. The VECM for the *IMM*, *GDP* and *UNE* is described by the following pair of equations:

$$\Delta\Delta GDP_t = a + \sum_{i=1}^{\rho} \beta_{1i} \Delta GDP_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} \Delta IMM_{t-i} + \beta_3 ECT_{t-1} + u_t$$
$$\Delta\Delta IMM = a + \sum_{i=1}^{\rho} \beta_{1i} \Delta IMM_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} \Delta GDP_{t-i} + \beta_3 ECT_{t-1} + u_t \tag{4}$$

and

$$\Delta\Delta UNE_t = a + \sum_{i=1}^{\rho} \beta_{1i} \Delta UNE_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} \Delta IMM_{t-i} + \beta_3 ECT_{t-1} + u_t$$
$$\Delta\Delta IMM = a + \sum_{i=1}^{\rho} \beta_{1i} \Delta IMM_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} \Delta UNE_{t-i} + \beta_3 ECT_{t-1} + u_t \tag{5}$$

To test for Granger non causality between the variables analyzed in this study we employ two separate tests. An *F*-test for the joint null hypothesis that $\beta_{2,1=}\beta_{2,2} = ... = 0$ and a *t*-test for the null hypothesis $\beta_3 = 0$. A significant *F*-statistic implies short-run causality, while a significant t-test implies long-run causality.

Table 6. Results of the Granger causality tests

	F-statistic	$ECT_{(t-1)}$
Immigration does not Granger cause GDP	0.21	0.01
	(0.89)	(0.01)
GDP does not Granger cause Immigration	0.08	-0.40***
	(0.92)	(0.07)
Immigration does not Granger cause UNE	0.17	-0.08
	(0.91)	(0.05)
UNE does not Granger cause Immigration	0.63	-0.34***
	(0.54)	(0.06)

Notes: Optimal lag determination according to BIC. *** indicates the rejection of the null hypothesis at the 1% significant level.

The results from the Granger causality tests are reported in 6. When causality between immigration and the growth rate of per capita GDP is considered, he coefficient of the lagged error correction term is statistically significant at the 1% significant level with a negative sign. This finding implies that immigration Granger causes per capita GDP in the long-run. On the other hand, the F-statistics suggest that we can not reject the null hypothesis of no short-run Granger causality between immigration and GDP. When it comes to the Granger causality between immigration and unemployment, we can not reject the null hypothesis that immigration does not Granger cause unemployment, but we reject he null hypothesis that unemployment does not Granger cause immigration. Finally, the F-test indicates no evidence of short-run causality in either direction.

7. Conclusions

Over the last three decades Greece has been transformed from a traditional country of emigration to a net receiver of immigrants. Today, Greece's border with Turkey is the main route of immigrants -from the Middle East, Africa and Southern Asia- who seek entry into Greece and European Union. The main objective of the present paper was to examine the causal relationship between the share of immigrants in Greece and two macroeconomic variables: unemployment and real per capita GDP. Our dataset consists of annual data over the period 1980-2011. Our results are not in line with the findings from the study of Boubtane et al. (2011) who use a different estimation strategy for the 1980-2005 period and found no evidence of causality in either direction.

Applying cointegration analysis we found evidence of long run relationship between the variables under consideration. The results are somewhat stronger for the case of immigration and GDP. Moreover, Granger non-causality tests indicate the existence of long-run causality running from the growth rates of GDP and unemployment to immigration, but not vice versa. Hence, our empirical results suggest that migrants do not cause unemployment and economic growth in the sense of Granger. Considering the results from immigration to unemployment, we may conclude that immigrants' effect on the labor demand creates a significant number of jobs. Regarding the statistical relationship from immigration to per capita GDP, we could infer that the "immigration surplus" is relatively too small to be captured by the cointegration analysis.

In contrast, the evidence suggests that immigration responds to economic growth and unemployment in Greece. Taking into account that the Greek government efforts have not been successful in controlling the borders, the results could be characterized reasonable and in line with our expectations.

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