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# Analysis of Granger Causality between Migration and Gross Domestic Product in Romania

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## Abstract

*In this paper, we aim at evaluating any relationship of causality between migration indicators (both emigration and immigration) and GDP for Romania, including an analysis considering the countries of destination and origin. On the basis of official statistical data, we hope to reach a valid conclusion as to whether the migration phenomenon poses a definitive influence on the GDP. The type of causality studied is the Granger one, by pursuing the Toda-Yamamoto methodology, as the GDP, considered for the purposes of this paper as GDP per capita, is highly expected to be non-stationary. The assessment of causality will aim the two directions, by pairs of indicators, emigration-GDP, immigration-GDP and net migration-GDP.*

**Keywords:** migration, immigration, GDP, causality, model.

**JEL Classification:** F22, O40

## 1. Introduction

As the world evolves, so is the phenomenon of migration. Migration has been around for centuries, and since the free circulation of human capital among European countries, this phenomenon is becoming more and more present in the European Union and not only. As Blouchoutzi & Nikas (2014) state, large-scale emigration can be noticed after the collapse of the socialist system and of the economies of some Eastern European countries.

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Well-known information about migration is that it has an economic impact on both parties involved: on the economic development of the country from which the human capital is leaving, and also on the economic growth of the country that receives the new flux of people. But the information and results regarding the nature and the dimension of this impact differ from one study to another. This lack of uniform results makes migration a debated topic of discussion in the economic literature. In this study, we analyse both emigration and immigration and their impact on the economic growth of a country.

## 2. Problem Statement

Emigrants, peoplewho leave their native country, are considered to have an impact on the economic development of the country they leave behind. But what kind of impact? Some studies consider this impact to be a negative one. This particular hypostasis has a logical argumentation. Since human capital is leaving, so is its contribution to the economy. ItIt does not pay taxes and itit does not put any money back in the economy. Atoyan et al. (2016) mention the fact that the emigration of skilled and qualified persons can reduce the labour force and productivity, having a negative impact on the economic growth of the country of emigration. Kindleberger (1965) sees output reduction and human capital export as main losses determined by emigration. Madhavan (1985) also talks about a "skill drain" as a cost in the long run that can reduce development, if emigrants are professionally trained and highly educated. Kindleberger (1965) calls this a dynamic loss, where young, productive and skilled persons leave the country.

So, in theory, emigrants influence in a negative way particularly the economic development, the Gross Domestic Product (GDP) of the country they leave behind. But is this really true? Other studies argue that emigrants do contribute to the economic growth through remittances, the sum of money they send back home, to their family, money that re-enter the economic circuit of the country from which they left. A study on the causality between remittances and GDP has been presented by Păunică et.al. (2019). Kindleberger (1965) presents remittances and forgone consumption as main benefits of emigration. Remittances are considered by Blouchoutzi & Nikas (2014) as a compensation for the countries of emigration, for loss of their human capital. Their study reveals that remittances contribute to the formation of the gross fixed capital, but the impact on economic growth depends on the way remittances are used by the country that receives them. Madhavan (1985) also identifies remittances as a factor that improves the balance of payment, while Rapoport & Docquier (2006) consider that the economic performance of a country is positively influenced by emigration and remittances in the long run. But is the gain obtained through remittances at least equal, if not greater, than the cost of the lost human capital? Can emigration be a positive thing for a country and its economy?

In return, immigrants, people that enter another country, other than their native place, may also have an influence on the economic development of the country they enter. But the question remains the same. What kind of impact? According

to the international literature, immigration tends to have a favourable impact on the economic development of the country that receives the new human capital (Bove & Elia, 2017). Morley's (2006) study can also offer evidence for a long run causality relation from economic growth per capita to immigration. Muller (1989) also considers that immigrants contribute to economic growth. Păunică etal. (2018) have analysed some facets of globalization, by outlining the behaviour of globalization indicators.

Immigrants' influence can be a positive one, based on a logical argument: they contribute to the economy by paying taxes and inserting money back into the economy in which they live. Neal & Uselding (1972) consider that immigration contributes to capital stock through social savings. Chiswick et al. (1992) consider that an increase in the immigration rate may have a favourable impact on the capital formation and also on the native population's income. The OECD study brings to our attention that migrants' contributions in taxes exceed the benefits they receive and also that migration boosts the percentage of the population that is of working age, stating that if migration expands the workforce, the GDP at an aggregate level is expected to grow (http://www.oecd.org/migration/OECD%20 Migration% 20Policy%20Debates%20Numero%202.pdf). Boubtane et al. (2013) demonstrate that immigration has positive influence on the GDP per capita and a negative influence on aggregate unemployment, but in turn it is influenced by the economic condition of the country to which people migrate. They also state that the positive influence of immigration on economic growth can be enhanced by the immigrants' level of education.

We should also take into consideration, while talking about the beneficial influence of immigration, that immigrants can bring with them new knowledge, know-how and other valuable information that can be beneficial to a country's development. Bove & Elia (2017) support the premises that migrants bring with them, in the advantage of the country they move to, new perspective and skills that can contribute to economic development or even technological innovation. The OECD study also brings to our attention that migrants possess certain skills and abilities, contributing to technological progress, research and innovation and human capital development, and contrary to our expectation, are not a burden for the economy (http://www.oecd.org/migration/OECD%20Migration% 20Policy%20 Debates%20Numero %202.pdf). Boubtane et al. (2016) considers that immigrants can contribute to innovation and technological progress through their skills, and confirm a small positive influence of migration on the GDP per capita.

But can immigration also have a negative influence? The country receiving immigrants also has to pay the cost of their assimilation and introduction to the economy. If immigrants are not productive in return, the cost can exceed the benefits they bring to the economy. Borjas (1995) considers that fiscal costs are superior for unskilled immigrants, due to the fact that they are more likely to pay fewer taxes and also use government services. We can also bring into discussion here the communication, cultural and other social barriers to an efficient integration of immigrants into employment, which can make their contribution less beneficial

to the economy. Bove & Elia (2017) mention that, economic growth can be negatively influenced by the diversity immigrants bring, by the barrier of communication and coordination. Nevertheless, the result suggests that the diversity brought by immigration is in general favourable for economic growth.

We should also mention that, in the case of immigration, we face another problem, which is also intensively debated in the literature. By employment, immigrants and natives will tend to apply for the same position at the same company. Is the demand in the labour market great enough to support the integration of everyone? Or may the country also face unemployment? Immigrants can compete with native-born persons on the labour market and also can determine a decrease in the wages offered by the employer, but evidence to support this hypothesis is scarce (Friedberg & Hunt, 1995). Boubtane et al. (2013) consider that immigration does not have a negative impact on employment opportunities.

All these uncertainties can hinder the economic development of the country that receives immigrants. So, the question remains the same. Is the gain obtained by accepting immigrants at least equal, if not higher, than the costs? Can immigration be a positive thing for a country and its economy?

If we look closely at the international studies, the answer to our questions becomes obvious: it depends! It may not be the answer we look for, it may not be clear, but it might be true. It depends. It depends on numerous factors, such as the level of education of the person that leaves or enters a country, its age, health and so on. As Madhavan (1985) said, the influence that emigration has on economic development is affected by a series of elements such as population growth, number of emigrants and their characteristics, the volume of remittances, and so on. Borjas (2019) also considers that the relation between immigration and growth is influenced by the size of the immigration phenomenon, the skills, knowledge and ability of the immigrants and the degree of assimilation, stating that immigration is more beneficial in terms of economic grow if immigrants are high-skilled workers that pay taxes and are not a burden. For Hanson (2012), innovation is also supported by high-skilled immigrants who also pay more taxes and contribute to productivity growth.

In order to better understand the impact of migration (in term of emigration and immigration) on the GDP, in the following sections we analysed the particular case of Romania.

## 3. Research Questions / Aims of the Research

The question this study addresses is the existence of a Granger causality relationship between three indicators of migration (immigration, emigration and net migration) and the economic growth, measured by the Gross Domestic Product per capita, in Romania.

Subsequent to this question, we have defined the following research hypotheses:

- H1. Emigration causes the Gross Domestic Product per capita.
- H2. Immigration causes the Gross Domestic Product per capita.
- H3. Immigration net migration causes the Gross Domestic Product per capita.

## 4. Research Methods

The research method applied for this study was the Toda-Yamamoto method for Granger Causality, and is based on the algorithm presented by Giles (2011). The suitability of this method for the study derives from two reasons:

- the size of the sample;
- the probability (not known before) to deal with non-stationary variables, moreover they could be integrated as different order variables, which also prevents the application of the regression between the first differences.

All data were extracted from the Romanian National Institute of Statistics Tempo online database. The dataset involves four components:

- emigration (dataset "*Permanent emigrants by country of destination*", code *POP309D*, metadata available in the Tempo database, see NSI, 2020a). The data selected include total values and values by countries, and the measurement unit is the number of persons.
- immigration (dataset "*Permanent immigrants by country of origin*", code *POP310D*, metadata available on Tempo database, see NSI, 2020b). The data parameters are the same as those used for the previous indicator.
- Gross Domestic Product per capita, dataset "*CON107B - The main aggregates per inhabitant - ESA 2010*", indicator *"Gross Domestic Product"*, expressed in "*Current prices, lei*". Metadata are available on Tempo database, see NSI, 2020c).

Our dataset covers the interval between 1995 and 2018, the geographical dimension refers to Romania, highlighting, within the dataset, the countries of origin (for immigration). The analysis of immigration refers to the analysis of the total number of migrants and the analysis of the number of migrants by continents: America, Europe and other countries.

Given the fact that we applied Eviews® to analyse our data, the methodology was implemented with the following characteristics (derived from the structure of our dataset):

Unit root tests. The tests applied were the Augmented Dickey-Fuller (ADF, for a maximum of 5 lags, automatic lag selection based on the *Schwarz Info Criterion*) and the Phillips-Perron (PP, with *default Bartlett kernel spectral estimation method* and *automatic selection* based on *Newey-West bandwidth*). Given the evolution of the datasets, the tests were applied for the *Trend and intercept* option.

Estimation of VAR models. For each pair of variables, a VAR model was designed, with an initial lag established on the basis of the optimum criteria, for a maximum of four lags (the value was chosen as indicated by the majority of the criteria, when no majority existed, the SIC criterion was given preference).

Test of the VAR models, namely the four tests:

AR roots test;

Autocorrelation LM test;

Normality test: Cholesky of covariance (Lutkepohl);

White heteroskedasticity test (No Cross Terms).

Giles (2011) indicates that, in case of unsatisfactory stability (AR roots) or autocorrelation, the maximum lag length should be increased by one unit, until these issues are solved. But Hacker and Hatemi-J (2003) indicate that misleading results can be obtained through Toda-Yamamoto method, if the normality and ARCH tests display unsatisfactory results.

Therefore, we have applied Giles's (2011) instructions for stability and autocorrelation problems, but, if a model failed the normality and heteroskedasticity tests, it has not been considered for the application of the following stages.

After this step, the models were set to a maximum lag length that reflects the maximum possible compliance with the tests, under the rules defined in the above paragraphs.

Application of the modified Wald test for the suitable models, following the procedure described by Giles (2011).

Subsequent to the tests applied for original data, we have attempted to analyse the causality between the logarithms of initial values, and thus discover any causality between the elasticity of the migration indicators and the elasticity of the GDPC.

## 5. Findings

### *5.1. Emigration and Gross Domestic Product per capita*

The first step was to test the unit roots for the two data series, and the results are presented in table 1.

**Table 1. Degrees of integration**

| Test | Emigration | GDPC |
|---|---|---|
| ADF | 1 | 2 |
| PP | 1 | 2 |

*Source:* Authors' representation, based on the application of ADF and PP tests

Both tests indicate the same order of integration, and the maximum order, to be applied in the final step of the analysis is therefore 2.

The maximum lag length for the estimated VAR model (named var_em) has been established by interpreting the information criteria.

After applying the specification tests on the VAR(1) model, the results of the stability (AR roots) test cannot be accepted, even after defining a VAR(7), while VAR(8) is impossible to be configured, as there are not enough data available. Therefore, we cannot proceed further with the desired test of Granger causality.

The analysis of logarithm data began, as well, with the order of integration for the target variables. All variables were found to be I(1). A VAR model was then estimated, at an optimum lag length of 1…1. The next step (the reliability tests) indicates a stable model, but there are signs of non-normality and heteroskedasticity, therefore the model cannot be used in future analyses.

### *5.2. Immigration and Gross Domestic Product per capita*

The unit root tests for the two variables outlined the following results:

**Table 2. Degrees of integration**

| Test | Immigration | GDPC |
|---|---|---|
| ADF | 2 | 2 |
| PP | 1 | 2 |

*Source:* Authors' representation, based on the application of ADF and PP tests

Even if different orders of integration are obtained after interpreting the parameters of the two tests, there is no influence on the final step of the methodology, as GDPC is I(2).

The VAR(IM GDPC) was then estimated, with an optimum lag length of 1…1, as indicated by all information criteria applied on the model. Following this adjustment, the model was then subjected to specification tests, but, the stability issues persisted, as in the case of immigration, up to maximum lag length 7 (at least one root above 1 has been found in each one of the seven models estimated).

When analysing the logarithm data, we start from a maximum order of integration that is 1, and a VAR(1) after assessing the results of information criteria tests.

The model is not stable and cannot be brought to a stable state, even if it is transformed to VAR(7).

### *5.3. Net migration and Gross Domestic Product per capita*

The unit root tests led to the following orders of integration for the two variables:

**Table 3. Degrees of integration**

| Test | Net migration | GDPC |
|---|---|---|
| ADF | 2 | 2 |
| PP | 1 | 2 |

*Source:* Authors' representation, based on the application of ADF and PP tests

Because GDPC is I(2), this is the maximum order of integration that can be applied in the final step. We have estimated the initial VAR as VAR(1), as indicated by all information criteria. However, during the stability test, unit roots above 1 prevent the use of the model for further testing.

As in Romania, the net migration has some negative values, it is not possible to extract logarithms from the data.

### *5.4. Immigration from Europe and Gross Domestic Product per capita*

The data regarding the immigration from Europe was computed by the authors, by aggregating the data for the European countries of origin.

The order of integration has been evaluated to 2 for all variables, and confirmed by both tests applied.

The initial VAR(3) model was unstable, so the lag length was gradually extended to the maximum allowed (7). However, none of the AR root tests succeeded.

### *5.5. Immigration from America and Gross Domestic Product per capita*

Both ADF and PP test verified that the immigration variable is I(1), while GDP is I(2).

Having designed the VAR model between the variables, the optimum lag length was 4. But, as in the previous case, the model presents roots above 1 and we cannot move further (the maximum lag length was increased to 7).

## 6. Conclusions

Despite our initial hopes, no model was suitable for analysis, as we chose to follow the conservative approach to VAR testing, described in the research methodology. The dataset had a fair number of observations, but still not enough to allow an increase in the lag length, to allow better exploration of the research hypotheses. The orders of integration for the variables approached made the attempt to use the regression between first differences not applicable.

We hope that, as datasets increase in number of observations, we will be able to pursue the research hypotheses defined in this paper, in the future. The topic is very important for the economy and society, and sound results obtained from analyses can contribute to the better understanding of the phenomenon. Furthermore, the intention of the authors is to expand the study, first at the level of the European Union, in the hope to achieve more significant outcomes.

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