# The shadow economy: a relevant factor for investment decisions in selected European Union countries

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**Abstract**

*The estimation of sovereign risk indicators has a key role for the investment decisions. We were witnesses of inaccurate ratings before the last economic crisis, which altered significantly the results expected by many investors. Thus, we propose an improved rating estimation justifying the insertion of new variables, specifically, the shadow economy as a percentage of the GDP. We find that by taking it into account, the credit rating estimation improves. Our estimation assigns a higher sovereign risk to the new European Union member states, whereas the old European Union member states see their sovereign risk decreased.*

*Keywords: shadow economy, sovereign risk, credit ratings, European Union, member states*

## 1 INTRODUCTION

Few are those economists or politicians who could have imagined in advance the macroeconomic changes that have been taking place since the beginning of the last global economic crisis. In the early 2000s it was unthinkable that some European Union (EU) countries would come close to the economic, social and political collapse they have recently been experiencing. The public debt of many of them increased and their financing became more and more costly at the same time that their credit ratings got worse. In such an uncertain economic environment, taking investment decisions becomes a particularly complex task. Currently, there are still some EU countries that make strenuous efforts to get out of the crisis.

Some EU countries have also large informal sectors, which suggests that the size of the shadow economy may be a relevant factor in explaining the delayed exit from the crisis.[1] Recent data (Schneider, 2013) show that the shadow economy in Europe has increased in absolute value, although as a percentage of the GDP it decreased slightly in the past few years.[2]

Authors like Roca, Moreno and Sánchez (2001), and Elgin (2012) find that the shadow economy is countercyclical. Furthermore, Ferreira (2008) proves that the bigger the size of the shadow economy in a country, the higher the tendency to experience greater volatility in economic activity cycles.

Unemployment, which has increased in most countries since 2008-2009, is another relevant factor that is directly related to shadow economy evolution (Dobre and Alexandru, 2009).

[1] Shadow economy refers to the economic sector that evades administrative control and inclusion in the official statistics. It is also known as the underground economy, black economy, informal economy, etc. According to the International Labour Organization, there are around 15 different terms. Its main aim is to avoid taxes and social insurance charges.

[2] EU-27, Norway, Switzerland and Turkey.

Elgin and Uras (2012) associate a larger shadow economy with a bigger public debt, a higher interest rate charged on public debt, a greater financial instability and, in consequence, a higher probability of sovereign default. In 2008 there were just two EU countries whose public debt was close to 100% of GDP: Italy and Belgium. In 2012, there were ten with debts close to or above 100% of GDP.[3] Public debt has increased in all EU countries since the beginning of the crisis.

Considering that indicators like public deficit, public debt, and debt interests are essential for credit rating, in countries with large shadow economies, a tax rise can increase the size of the underground economy and reduce the government surplus that the tax rise was supposed to generate. A decrease in government spending could reduce the formal production, leading to a decrease in the size of the fiscal revenues, limiting again the government surplus generated by the reduction in government purchases. Thus, a tax rise or a decrease of government purchasing would increase the debt, and according to Elgin and Uras (2012), in the presence of a shadow economy, the probability of sovereign debt restructuring as well as the sovereign debt interest will tend to increase. Obviously, substantial reductions of the shadow economy could lead to a significant increase in tax revenues (Schneider and Enste, 2000), which would help to reduce the state's public deficit.

Despite the evident relationship between a country's performance and its underground economy, to the best of our knowledge, the latter has not been considered by the credit rating agencies in their assessments. Credit rating agencies provide information, to big companies or governments, regarding the likelihood that a country will repay its loans; therefore, they become particularly relevant in times of economic uncertainty.[4] These ratings should help investors identify their optimal investment decisions.

We propose to find ways to improve the credit ratings estimation by involving new factors. In particular, we will verify whether the shadow economy alters the sovereign risk estimation; the literature suggests that a sizable shadow economy could have a negative effect on economic stability and economic recovery. Moreover, while a large part of the existing literature adds more and more details on the causes of the shadow economy, and quantifies it (Schneider, 1998; 2002; 2007; Schneider and Enste, 2000; Schneider and Klinglmair, 2004), there is still a shortage of studies on its consequences. This paper aims to shed some light on this dimension. The discussion on the causes of the shadow economy mainly emphasizes the tax burden, culture, as well as the labour market regulation and the quality of institutions (Ferreira, 2008; Schneider, 2010), suggesting that overregulation and labour costs in the official economy impel the irregular economy.

[3] Belgium, Ireland, Italy, Greece, Spain, France, Hungary, Austria, Portugal, UK.
[4] A regulation of the credit rating agencies in the EU came into force in 2009 as the agencies play a key role in the financial markets and their ratings are taken into consideration by investors, borrowers, institutions and governments when they make their financial decisions.

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The old EU member states have, in general, high credit ratings and small shadow economies as a percentage of the GDP.[5] However, the new member states have lower credit ratings and larger shadow economies.[6] We find that countries with low sovereign risk improve their credit rating when we include in the estimate the shadow economy as a percentage of the GDP. On the contrary, countries with higher sovereign risk see a negative alteration of their ratings when it is taken into account that they have, in general, a relatively large unofficial economy. This improved credit rating estimation should help investors to take more accurate decisions.

We organize the paper as follows. The next section refers to methodology, section 3 includes the variables and data used, in section 4 we present the results and the last section includes the conclusions.

## 2 METHODOLOGY

The factor analysis that we apply to our data, described in this section, is a technique that permits reduction of the data dimensions. What we are seeking with it, is to find a minimal number of dimensions able to explain maximally the data information.

Factor analysis is appropriate when there is a good correlation between the variables, and they are explained by common factors. The purpose of factor analysis is to identify and quantify such factors.

It consists of the following phases:

– A matrix calculation able to express the joint variability of all variables: we test the degree of correlation through the Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity.
– Extraction of an optimal number of factors. We use a principal component analysis technique as it permits a joint treatment of the observed variables, reducing the number of data, and identifies a group of fictitious variables drawn from the combination of the observed. This way we can reduce the data and interrelate these data without introducing an initial hypothesis as to what each initial factor means. The principal components or factors are obtained after a computing process of characteristic roots and vectors of a symmetric matrix and aim to contain the most variance explained while avoiding redundant information. The factors have to be uncorrelated with each other and have to be expressed as a linear combination of the variables that have been observed. The more variance incorporated in each one of the components or factors, the greater quantity of information it contains.

[5] The old EU member states are Denmark, Finland, Germany, Netherlands, Sweden, United Kingdom, Austria, France, Belgium, Ireland.
[6] The new EU member states are Estonia, Slovak Republic, Slovenia, Bulgaria, Latvia, Lithuania, Croatia, Romania, Hungary, Poland.

– Rotation of the solution in order to facilitate the interpretation. The interpretation of the factor analysis results is based on the correlations of the variables and on the factors. The factorial loads of a factor with the variables have to be between 0 and 1, so variables with loads close to 1 are explained largely by the factor. Then, a variable has to have high factorial load just with one factor. Thus, if it is not possible to find a good interpretation of the factors with the initial solution, the factors can be rotated and so each variable could have a correlation close to 1 with one factor and close to 0 with the others.
– Estimation of the factors' scores. Once we have the final factors' solution, we find the score estimation of the subjects in each one of the resulting factors' extraction. The obtained value summarizes the information contained in the original variables.

Thus, we proceed with the factor analysis in order to detect the structure in the relationships between variables. In this context, each variable can be expressed as a linear combination of indirectly observed factors.

$$X_{ij} = a_{i1} F_{1j} + a_{i2} F_{2j} + a_{i3} F_{3j} + \ldots + d_i U_{ij}$$

where:

$X_{ij}$ is the normalized value of the variable $i$ for the country $j$,
$a_{i1}$ is the relationship between variable $i$ and Factor 1,
$a_{i2}$ is the relationship between variable $i$ and Factor 2,
$F_{1j}$ is the value of Factor 1 for the country $j$,
$F_{2j}$ is the value of Factor 2 for the country $j$,
$d_i U_{ij}$ is a uniqueness that is independent of the previously described factors,
$d_i$ is the uniqueness of the variable $i$, and
$U_{ij}$ is the way that this uniqueness affects the country $j$.

Next, we carry out a variance analysis which permits testing of the null hypothesis about equal means versus the alternative hypothesis that at least one of the groups is different from the others regarding its expected value. This contrast is essential when the interest is to compare the factor with respect to the dependent variable, which in our case is the country type (see results section). ANOVA requires the following assumptions to be satisfied: normality of the dependent variable corresponding to each factor probability distribution, the samples should be independent, and all statistical populations are required to have the same variance.

ANOVA is based on the data's total variance decomposition with respect to the aggregated mean which under the assumption that the null hypothesis is true, is an estimation of the $q^2$ using the whole sample information in two parts:

– Variation within groups.
– Variation between groups.

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## 3 DATA

The credit rating agencies use a large number of variables for their estimations. Some of the most relevant are used in our analysis jointly with an additional one, the shadow economy, in order to test whether the estimation improves or not. The variables finally selected in the analysis are the following:

**GDP Per Capita** measures the standard of living. Even if the shadow economy does not represent a relevant share of the official economy, it reduces the GDP per capita.

**Real Investment (% change)**: there has been a relevant decrease in investment since the beginning of the crisis. We could not find a link in the literature between real investments and the shadow economy.

**Unemployment Rate (% of workforce)** is a variable that has experienced an increase in the last few years in many countries. Government expenditures on social programs also increased requiring additional tax revenues and producing a consequent increase of the public debt.

According to Alexandru, Dobre and Ghinararu (2011) and Dobre and Alexandru (2009), there is a direct relationship between the shadow economy and the unemployment.

**General Government Gross Debt (% GDP).** This variable also experienced an important rise in most countries and its reduction is especially difficult when growth is slow. Elgin and Uras (2012) point out that a larger shadow economy is related to higher public debt.

Other selected variables are **Deficit/Surplus (% GDP)** and **Primary Balance (% GDP)**.

**Fiscal Revenues (% GDP).** They decrease during economic downturns as household incomes fall. In the presence of a large shadow economy, fiscal revenues decrease.

**Fiscal Expenditures (% GDP).** A variable which rises automatically during recessions, as payments of unemployment and welfare benefits increase.

**Fiscal Interest Expenditures (% GDP).** Nowadays, due to the difficult economic situation many countries have to borrow in order to finance their relevant debts. In some cases, the interest expenditures increased substantially. Elgin and Uras (2012) suggest that in countries that have a large shadow economy and consequently a significant amount of tax evasion, fiscal policy adjustments could be questionable and the probability of debt defaults will grow, so the interest rates charged on sovereign debt increase, too.

**Shadow Economy (GDP).** As mentioned above, a high percentage of shadow economy has a direct relationship with the debt size and an inverse relationship with the business cycle.

Data for the first nine variables proceed from Standard and Poor's' statistics and those for the shadow economy are Schneider's (2013) estimations using the MIMIC approach. The reason for selecting Schneider (2013) as a source is that he provides a full set of data corresponding to the countries included in this study. All data are from 2012.

Once variables are described, we review the methods of shadow economy estimation. We briefly discuss direct and indirect methods and pay also some attention to the Multiple Indicators Multiple Causes (MIMIC) approach.

### 3.1 SHADOW ECONOMY DATA AND ESTIMATION

In the next lines we take a quick glance at the different methods used in the literature, and justify the data set we have selected. There are different direct and indirect methods to quantify the unofficial economy; all of them have their limitations. MIMIC is another approach, which focuses on the shadow economy's causes, but also on its consequences.[7]

Direct methods have high costs and it is necessary to assume certain sub-estimations. They are based on contacts with or observations of persons and/or firms, to gather direct information about undeclared income. Partially, they are based on the auditing of tax returns and on questionnaire surveys. Using direct surveys addressed to the economic agents is advantageous because they provide extensive information about tax evasion and about the shadow economy as a whole. The difficulties come with the selection of appropriate participants and their willingness to collaborate. According to Enste and Schneider (1998) direct methods are, in theory, reliable and simple, but in practice, less reliable and expensive.[8]

Indirect methods sometimes require not very realistic assumptions. The indirect methods measure the "traces" left by the underground economy in the official statistics. They are also called "indicator" approaches and use mainly macroeconomic data. These methods are used more often than the previous ones. They have a monetary or non-monetary character and may include different variables. Monetary methods, for instance, draw from the hypothesis that irregular transactions can be carried out using the most liquid form of money, especially cash and bank sight deposits. Indirect approaches contain information about the development of the shadow economy over time (Schneider and Klingmair, 2004). The size of the

[7] It is based on a dynamic multiple-indicators multiple-causes model, which includes a measurement model linking observable indicators to the size of the shadow economy and a structural equation model that links causes and consequences.

[8] It is possible that people who evade taxes do not want to respond honestly to surveys even though confidentiality is guaranteed.

shadow economy can be estimated through the discrepancy between national expenditure and income statistics, the discrepancy between the official and the actual labour force, the transactions approach, the currency demand approach, the electricity consumption method.

The multiple indicators multiple causes (MIMIC) approach or model approach is based on the statistical theory of latent variables. As Enste and Schneider (1998) explain, the underground economy is measured as an unobserved variable using a factor analytic approach. It consists, in general, of two parts: the measurement model, which associates the unobserved variable with observed indicators, and the structural equations model, which establishes the causal relationships among the unobserved variables. In order to proceed with the benchmarking and calculate the absolute values of the shadow economy, it is necessary to use other methods such as the currency demand approach.

The MIMIC approach has been used in the past 30 years by many authors, such as Helberger and Knepel (1988), Pozo (1996), Schneider (2003; 2007; 2013). However, it was strongly criticized by Breusch (2005), challenging the hypothesis of the MIMIC approach and indicating that some empirical results (Giles and Tedds, 2002; Dell'Anno and Schneider, 2003; Bajada and Schneider, 2005) he had analysed had no scientific value.

## 4 RESULTS

We begin by testing if it is suitable to conduct a factor analysis with the selected data used for the sovereign risk estimation.

Measuring the sampling adequacy, we find an acceptable result.

**Table 1**

*Results of measuring the sampling adequacy*

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin measure of sampling adequacy | | 0.534 |
| Bartlett's test of sphericity | Approx. Chi-square | 276.235 |
| | df | 36 |
| | Sig. | 0.000 |

*Source: Authors' findings.*

Furthermore, we find that the null hypothesis can be rejected, and the adjustment of the variables through factor analysis is suitable. When we repeat the same tests, but including the variable shadow economy as a percentage of the GDP, we find that the sampling adequacy KMO improves as its value becomes 0.613 and the null hypothesis is again rejected.

Following the extraction of factors, we examine the table of Communalities which shows us how much of the variance in each of the original variables is explained by the extracted factors.

**Table 2**
*Communalities*

| | Initial | Extraction |
|---|---|---|
| GDP Per Capita ($) | 1.000 | 0.858 |
| Real Investment (% change) | 1.000 | 0.620 |
| Unemployment Rate (% of workforce) | 1.000 | 0.667 |
| General Government Gross Debt (% GDP) | 1.000 | 0.799 |
| Deficit/Surplus (% GDP) | 1.000 | 0.976 |
| Primary Balance (% GDP) | 1.000 | 0.974 |
| Fiscal Revenues (% GDP) | 1.000 | 0.917 |
| Fiscal Expenditures (% GDP) | 1.000 | 0.904 |
| Fiscal Interest Expenditures (% GDP) | 1.000 | 0.915 |

*Extraction method: principal component analysis.*

*Source: Authors' findings.*

The communality is the sum of the squares of factorial loads in each row. Principal components analysis assumes that the total variance of each of the original variables is explained by all components, and therefore, the communality takes the initial value of one.

In the second column we can see the respective communality for each variable after the extraction of the factors. The variance of a variable is decomposed in the variance which is due to the common factors and to the unique factors. We observe that variables such as Deficit/Surplus, Primary Balance, Fiscal Revenues, Fiscal Interest Expenditure and Fiscal Expenditures explain the variance to a greater degree.

**Table 3**
*Communalities, with shadow economy (GDP)*

| | Initial | Extraction |
|---|---|---|
| GDP Per Capita ($) | 1.000 | 0.895 |
| Real Investment (% change) | 1.000 | 0.612 |
| Unemployment Rate (% of workforce) | 1.000 | 0.672 |
| General Government Gross Debt (% GDP) | 1.000 | 0.820 |
| Deficit/Surplus (% GDP) | 1.000 | 0.968 |
| Primary Balance (% GDP) | 1.000 | 0.970 |
| Fiscal Revenues (% GDP) | 1.000 | 0.882 |
| Fiscal Expenditures (% GDP) | 1.000 | 0.852 |
| Fiscal Interest Expenditures (% GDP) | 1.000 | 0.913 |
| Shadow Economy (% GDP) | 1.000 | 0.832 |

*Extraction method: principal component analysis.*

*Source: Authors' findings.*

The previous tables with and without the variable "shadow economy as percentage of GDP" show that the communalities for all variables are above 0.50. Thus, we do not exclude any of them from the analysis on the basis of low communalities.

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To determine how many factors to include, we choose the variance explained by each one of the extracted factors. This information is presented in tables 4 and 5. The results (without the variable Shadow Economy (% GDP) indicate that after selection of the first factor (FAC 1.1), which includes the variables Per Capita GDP, Real Investment (change), Unemployment Rate (of workforce), General Government Gross Debt (GDP), Deficit/Surplus (GDP), Primary Balance (GDP), Fiscal Revenues (GDP), Fiscal Expenditures (GDP), Fiscal Interest Expenditures (GDP), explains 40.8% of the total sovereign risk variance.

**Table 4**

*Total variance explained*

| Component | Initial eigenvalues | | | Extraction sums of squared loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 3.676 | 40.845 | 40.845 | 3.676 | 40.845 | 40.845 |
| 2 | 2.691 | 29.901 | 70.745 | 2.691 | 29.901 | 70.745 |
| 3 | 1.264 | 14.046 | 84.791 | 1.264 | 14.046 | 84.791 |
| 4 | 0.556 | 6.179 | 90.970 | | | |
| 5 | 0.472 | 5.241 | 96.211 | | | |
| 6 | 0.267 | 2.967 | 99.178 | | | |
| 7 | 0.072 | 0.797 | 99.975 | | | |
| 8 | 0.002 | 0.024 | 99.999 | | | |
| 9 | 0.000 | 0.001 | 100.000 | | | |

*Extraction method: principal component analysis.*

*Source: Authors' findings.*

Once we include the shadow economy (% GDP), we obtain an improved sovereign risk estimation. The total variance explained by the first factor becomes now 44.4%.

**Table 5**

*Total variance explained with the variable shadow economy (% GDP)*

| Component | Initial eigenvalues | | | Extraction sums of squared loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 4.436 | 44.364 | 44.364 | 4.436 | 44.364 | 44.364 |
| 2 | 2.691 | 26.911 | 71.274 | 2.691 | 26.911 | 71.274 |
| 3 | 1.291 | 12.909 | 84.184 | 1.291 | 12.909 | 84.184 |
| 4 | 0.581 | 5.813 | 89.997 | | | |
| 5 | 0.528 | 5.283 | 95.280 | | | |
| 6 | 0.300 | 2.996 | 98.276 | | | |
| 7 | 0.099 | 0.993 | 99.269 | | | |
| 8 | 0.071 | 0.710 | 99.978 | | | |
| 9 | 0.002 | 0.021 | 99.999 | | | |

*Extraction method: principal component analysis.*

*Source: Authors' findings.*

We extract three components and obtain the matrix presented in table 6.

**Table 6**

*Component matrix*

| | Component | | |
|---|---|---|---|
| | **1** | **2** | **3** |
| GDP Per Capita ($) | 0.859 | 0.201 | -0.282 |
| Real Investment (% change) | -0.596 | 0.394 | -0.331 |
| Unemployment Rate (% of workforce) | -0.580 | -0.569 | -0.082 |
| General Government Gross Debt (% GDP) | 0.724 | -0.455 | 0.262 |
| Deficit/Surplus (% GDP) | -0.314 | 0.888 | 0.297 |
| Primary Balance (% GDP) | -0.050 | 0.611 | 0.773 |
| Fiscal Revenues (% GDP) | 0.775 | 0.534 | -0.176 |
| Fiscal Expenditures (% GDP) | 0.867 | 0.296 | -0.255 |
| Fiscal Interest Expenditures (% GDP) | 0.520 | -0.600 | 0.534 |

*Extraction method: principal component analysis.*

*Source: Authors' findings.*

Table 6 shows the correlation coefficients of the original typified variables with the three retained principal components. GDP Per Capita, Fiscal Expenditures, Fiscal Revenues and Gross Debt have significant positive relationship with the first component. Once the variable Shadow Economy is included (see table 7), we can prove its strong negative relationship with the first component or factor. The variable GDP Per Capita is positively correlated to the first component in a higher degree. The variable Deficit/Surplus has again a significant positive relationship with the second component. Finally, Primary Balance has again a high positive correlation with the third component.

**Table 7**

*Component matrix, with the variable shadow economy (GDP)*

| | Component | | |
|---|---|---|---|
| | **1** | **2** | **3** |
| GDP Per Capita ($) | 0.890 | 0.202 | -0.251 |
| Real Investment (% change) | -0.561 | 0.393 | -0.378 |
| Unemployment Rate (% of workforce) | -0.580 | -0.570 | -0.106 |
| General Government Gross Debt (% GDP) | 0.732 | -0.454 | 0.280 |
| Deficit/Surplus (% GDP) | -0.323 | 0.861 | 0.275 |
| Primary Balance (% GDP) | -0.062 | 0.666 | 0.724 |
| Fiscal Revenues (% GDP) | 0.762 | 0.536 | -0.120 |
| Fiscal Expenditures (% GDP) | 0.853 | 0.297 | -0.189 |
| Fiscal Interest Expenditures (% GDP) | 0.484 | -0.599 | 0.566 |
| Shadow Economy (% GDP) | -0.898 | | 0.159 |

*Extraction method: principal component analysis.*

*Source: Authors' findings.*

The next step in the analysis is the variance analysis of the first factor (FAC 1.1) and the variable *countrytype*[9] (see table 8a).

The means are different for each group. The critical probability value and the statistical Fisher-Snedecor value are shown in table 8b. The p-value is less than 0.05 and the null hypothesis of equal means is rejected, so there are differences in the means of each group and therefore sovereign risk is different for each group. The result for the new member states is negative which explains their higher risk rating and it is positive for the old member states, and this explains their lower risk rating.

**TABLE 8**

*One way ANOVA I*

**a) REGR factor score 1 for analysis 1**

| | N | Mean | Std. deviation | Std. error | 95% confidence interval for mean | | Min. | Max. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower bound | Upper bound | | |
| New member states | 10 | -0.7919 | 0.4745 | 0.1500 | -1.1312 | -0.4524 | -1.2676 | 0.2133 |
| Old member states | 10 | 0.7919 | 0.7018 | 0.2219 | 0.2898 | 1.2939 | -0.5976 | 1.8981 |
| Total | 20 | 0.0000 | 1.0000 | 0.2236 | -0.4680 | 0.4680 | -1.2676 | 1.8981 |

**b) REGR factor score 1 for analysis 1**

| | Sum of squares | df | Mean square | F | Sig. |
|---|---|---|---|---|---|
| Between groups | 12.541 | 1 | 12.541 | 34.950 | 0.000 |
| Within groups | 6.459 | 18 | 0.359 | | |
| Total | 19.000 | 19 | | | |

*Source: Authors' findings.*

The variance analysis with FAC 1.2 as dependent variable and *countrytype* indicates again that the means are different for each group, so the sovereign risk is different for each group. That is to say, the results are similar to those of ANOVA 1 (see table 8).

[9] At this stage we distinguish between old and new EU member states. The old member states take value 1 and the new member states, value 0.

**TABLE 9**
*One way ANOVA II, with the variable shadow economy (GDP)*

**a) REGR factor score 1 for analysis 2**

| | N | Mean | Std. deviation | Std. error | 95% confidence interval for mean | | Min. | Max. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower bound | Upper bound | | |
| New member states | 10 | -0.8330 | 0.4204 | 0.1330 | -1.1337 | -0.5322 | -1.3497 | 0.0201 |
| Old member states | 10 | 0.8330 | 0.6265 | 0.1981 | 0.3848 | 1.2811 | -0.4433 | 1.7548 |
| Total | 20 | 0.0000 | 1.0000 | 0.2236 | -0.4680 | 0.4680 | -1.3497 | 1.7548 |

**b) REGR factor score 1 for analysis 2**

| | Sum of squares | df | Mean square | F | Sig. |
|---|---|---|---|---|---|
| Between groups | 13.877 | 1 | 13.877 | 48.754 | 0.000 |
| Within groups | 5.123 | 18 | 0.285 | | |
| Total | 19.000 | 19 | | | |

*Source: Authors' findings.*

The comparison between the groups confirms our hypothesis. According to the results obtained in the first part of the analysis and using traditional variables, the mean value for the first group, new member states, was negative, which explains their lower credit rating (-0.792). However, the result was positive (0.792) for the group of old member states, which explains their low sovereign risk.

When the shadow economy as a percentage of GDP is considered, the results change. The means in this case are different from the previous means. There is a negative increase for the new member states, which suggests that their sovereign risk has been increased (-0.833), while in the group of the old member states, the result improves (0.833), which allows us to accept that their sovereign risk has been reduced.

As a previous step to the above justification, a linear association between FAC 1.1 and FAC 1.2 is made and a Pearson correlation coefficient is calculated. Following that is Spearsman's rho, which measures the association between FAC 1.1 and FAC 1.2 at ordinal level. We obtain that one explains the other with almost 99% of variance.

**TABLE 10**
*Correlations*

**a)**

| | | REGR factor score 1 for analysis 1 | REGR factor score 1 for analysis 2 |
|---|---|---|---|
| REGR factor score 1 for analysis 1 | Pearson's Correlation | 1 | 0.992** |
| | Sig. (2-tailed) | | 0.000 |
| | N | 20 | 20 |
| REGR factor score 1 for analysis 2 | Pearson's Correlation | 0.992** | 1 |
| | Sig. (2-tailed) | 0.000 | |
| | N | 20 | 20 |

*Note: Correlation is significant at the 0.01 level (2-tailed).*

**b)**

| | | | REGR factor score 1 for analysis 1 | REGR factor score 1 for analysis 2 |
|---|---|---|---|---|
| Spearman's rho | REGR factor score 1 for analysis 1 | Correlation coefficient | 1.000 | 0.985** |
| | | Sig. (2-tailed) | | 0.000 |
| | | N | 20 | 20 |
| | REGR factor score 1 for analysis 2 | Correlation coefficient | 0.985** | 1.000 |
| | | Sig. (2-tailed) | 0.000 | |
| | | N | 20 | 20 |

*Note: Correlation is significant at the 0.01 level (2-tailed).*
*Source: Authors' findings.*

## 5 CONCLUSIONS

Investment decisions are becoming more and more complex, thus, in these circumstances, the availability of reliable information is essential. Although the role of credit rating agencies is to guide investors' decisions, credit ratings have not been sufficiently reliable indicators in the past years.

The literature documents a strong link between the shadow economy and a country's main economic variables. However, credit rating agencies have failed to take this relationship into account when assessing sovereign risk. The purpose of this paper was to analyze whether including the shadow economy into the estimation of the sovereign risk index of some selected old and new EU member states improves it or not. The results showed that the new EU members, that is, a country that is characterized by a relatively larger shadow economy and a lower GDP per capita than the old members, would acquire a worse credit rating. Conversely, the old EU member states would see their credit ratings improved.

## ANNEX 1

*S&P credit ratings (2012)*

| Country | Rating | Outlook |
|---|---|---|
| Denmark | AAA | Stable |
| Sweden | AAA | Stable |
| United Kingdom | AAA | Stable |
| Germany | AAA | Stable |
| Finland | AAA | Stable |
| Netherlands | AAA | Stable |
| Austria | AA+ | Negative |
| France | AA | Stable |
| Belgium | AA | Negative |
| Ireland | A | Stable |
| Estonia | AA- | Stable |
| Slovak Republic | A | Positive |
| Slovenia | A- | Stable |
| Bulgaria | BB+ | Stable |
| Latvia | A- | Stable |
| Lithuania | A- | Stable |
| Croatia | BB+ | Stable |
| Romania | BBB- | Stable |
| Hungary | BB | Stable |
| Poland | A- | Positive |

*Source: S&P Statistics.*

## ANNEX 2

*Shadow economy in selected European countries (2012) (%)*

| Country | Share of shadow economy |
|---|---|
| Denmark | 13.4 |
| Sweden | 14.3 |
| United Kingdom | 10.1 |
| Germany | 13.3 |
| Finland | 13.3 |
| Netherlands | 9.5 |
| Austria | 7.6 |
| France | 10.8 |
| Belgium | 16.8 |
| Ireland | 12.7 |
| Estonia | 28.2 |
| Slovak Republic | 15.5 |
| Slovenia | 23.6 |
| Bulgaria | 31.9 |
| Latvia | 26.1 |
| Lithuania | 28.5 |
| Croatia | 29.0 |
| Romania | 29.1 |
| Hungary | 22.5 |
| Poland | 24.4 |

*Source: Schneider (2013).*

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