PUBLIC DEBT IN LIGHT OF BARRO-RICARDO HYPOTHESIS: EMPIRICAL ANALYSIS

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Abstract

Public debt is a hot contemporary issue for all – economists, politicians and public media. A continuous increase of public debt in most European countries in past decades has recently become a great threat not only for particular economies but the EU as a whole. However the debt debate focuses mainly on public debt and not the private debt and household saving. On the other hand it was the private debt which was substantially affecting the economy development during the US housing crisis. Possibly if the market was convinced that households have high savings and the risk of massive housing sales is low, than the subsequent financial crisis could have been much weaker or not appear at all. The paper deals with the general analysis of public debt in EU member states with focus on Barro-Ricardo preposition empirical verification. We show that countries with higher public debt tend to have higher saving ratio. This is resulting in possibility of financing the public debt trough private domestic funds and to repel the public finance bankrupt. It is a question how to convince the public to finance the public debt – whether to increase the taxes or find other tools. In every case it is necessary to explain the government steps very well as although there is a scope to finance the public debt it is necessary to find the public will to do it.

Key words: public debt, external debt, household saving, Barro-Ricardo proposition

JEL Code: H60, E62

1 Introduction - The European Debt Problem

The public debt issue is currently in focus of economists, politicians, media and public. Ongoing indebtedness of highly developed (mainly European) countries is now in such breaking point where these countries are facing up the bail out and are threatening economical stability of the whole region. The reason is not only in single currency but above all in global interconnection of financial markets and economical cohesion of national businesses. It would be probably unwise, alike as in case of American mortgage crisis, to consider that debt crisis, bail out and subsequent deep recession of major European countries as Italy or Spain will not

substantially affect the domestic economy. It's quite a paradox that major European economies are currently under pressure caused by problems of other not very economically important countries, namely Greece. It turns out that public debt similarly to a standard financial market behavior is dependent more on a market sentiment than on fundamental factors. For example the Italian public debt was for long period higher than the Greece one but until recently it has not been considered as immoderate. No rating agency has mentioned possibility of insolvency or bail out. Table 1 shows the public debt development in EU member states i:

Table 1: EU Member States Public Debt

GEO/TIME	2001	2005	2010	% growth (2001-2010)
EU 27	61.0	62.8	80.0	31.15
Belgium	106.6	92.1	96.8	-9.19
Bulgaria	66.0	27.5	16.2	-75.45
Czech Republic	24.9	29.7	38.5	54.62
Denmark	49.6	37.8	43.6	-12.10
Germany	58.8	68.0	83.2	41.50
Estonia	4.8	4.6	6.6	37.50
Ireland	35.5	27.4	96.2	170.99
Greece	103.7	100.0	142.8	37.70
Spain	55.5	43.0	60.1	8.29
France	56.9	66.4	81.7	43.59
Italy	108.8	105.9	119.0	9.38
Cyprus	60.7	69.1	60.8	0.16
Latvia	14.0	12.4	44.7	219.29
Lithuania	23.1	18.4	38.2	65.37
Luxembourg	6.3	6.1	18.4	192.06
Hungary	52.0	61.8	80.2	54.23
Malta	62.1	69.6	68.0	9.50
Netherlands	50.7	51.8	62.7	23.67
Austria	67.3	64.6	72.3	7.43
Poland	37.6	47.1	55.0	46.28
Portugal	51.2	62.8	93.0	81.64
Romania	25.7	15.8	30.8	19.84
Slovenia	26.7	26.7	38.0	42.32
Slovakia	48.9	34.2	41.0	-16.16
Finland	42.5	41.7	48.4	13.88
Sweden	54.7	50.4	39.8	-27.24
United Kingdom	37.7	42.5	80.0	112.20

Source: Eurostat, own elaboration

Obviously Greece is not the champion in long term debt dynamics. Public debt has grown rapidly in many other European countries like Ireland, United Kingdom or Lithuania. The rapid increase of Greece debt occurred as late as 2009 and 2010 (30% growth compared to year 2008). Main reasons were deep economic recession and preceding unhealthy increase of governments' expenditure. Actually it was the fierce increase of speed what frightened

investors, financial institutions and even rating agencies which were giving Greece lower and lower ratings. That situation negatively affected interest rates of Greece bonds[1]. The market lost its trust in Greece and it is very unlikely that this could be changed in near future by any of ECB actions. Nevertheless the Greece case raised attention of investors, economists and politicians towards the debt problem of other countries and pass on the investors distrust "contagion" on others. Countries with high dynamic of indebtedness were subsequently marked as problematic. Among befallen were namely Ireland and Portugal but surprisingly not the Great Britain where the growth rate of public debt in years 2009 and 2010 was significantly higher than in Greece. However if we consider the debt level itself, then we cannot say it is dramatically high in Great Britain in comparison to other EU countries. Also UK is currently not facing the problem of credibility, the inability to service the debt in view of economical output, as Greece. However it is quite clear that financial markets are considering not only the debt level but also its dynamics. We may try to develop a very simple indicator of riskiness of a country based on multiplicative criterion. It is reached by multiplying the average debt growth rate of a country between by its debt to GDP ratio. We assume adaptive expectations of investors and focus on short period 2009-2010 and long period 2001-2010. Table 2 ranks countries according their riskiness.

1 Greece´s rating decrease in December 2009 from A1 to A2. Greece has been borrowing at 5.2% rate of interest. It was nothing special for this country because there was an average rate of 6% in year 2001. However during 2010 the interest rate increased to 5.5% and the rating was shifted to BB+ and finally to CA.

Table 2: Indicator of Riskeness

Indicator (2009-2010)		Indicator (2001-2010)	
Ireland	208.4333	Ireland	260.6885
Greece	184.2081	Greece	196.6426
Italy	133.2173	United kingdom	169.7613
Portugal	120.7961	Portugal	168.9258
United kingdom	117.6471	Latvia	142.7207
Belgium	104.5786	Italy	130.1563
Germany	104.4078	Hungary	123.6931
EU 27	102.7287	Germany	117.7252
Latvia	101.4259	France	117.3091
France	98.59513	EU 27	104.918
Lithuania	93.54103	Belgium	87.90094
Spain	90.75402	Poland	80.45213
Hungary	88.96321	Austria	77.67147
Austria	81.93245	Netherlands	77.54024
Cyprus	76.53499	Malta	74.46055
Malta	75.18699	Spain	65.08126
Romania	70.79403	Lithuania	63.17056
Finland	68.69677	Cyprus	60.90016
Netherlands	67.54794	Czech Republic	59.52811
Slovenia	65.93607	Finland	55.11906
Poland	64.22505	Slovenia	54.0824
Slovakia	60.46763	Luxembourg	53.73968
Denmark	55.10029	Denmark	38.32581
Czech Republic	49.40833	Romania	36.91206
Sweden	40.82577	Slovakia	34.37628
Luxembourg	24.89412	Sweden	28.95868
Bulgaria	19.1562	Estonia	9.075
Estonia	9.469565	Bulgaria	3.976364

Source: Eurostat, own elaboration

It is quite clear that countries with the highest score are those which are today among the risky PIGS group (Portugal, Spain, Italy and Greece). There is one exception – Spain. Spain does not have either relatively high public debt to GDP ratio or its dynamics. Probably the reason why it is among these countries is its regional location and economic similarities (it was a cohesion country along with Portugal and Ireland).

2 External Debt

The next significant factor which might affect the riskiness public debt is country's ability to service the debt. This is related with long term growth of GDP when countries with low or unstable GDP growth are considered as problematic. Simultaneously we have to perceive the debt as a structural issue. Above all we need to distinguish between the domestic debt and the foreign debt, where the domestic one is for national economics less dangerous. Simply we

may assume that in case of domestic debt households owe each other and interests remain in national economics (Scott 2010). On the other hand if substantial part of public debt is held by non-residents than the interest flows away. Such situation naturally hampers the economic growth. If we take look at the most risky countries from above, we find out that actually Greece, Portugal and Ireland have relatively high share of foreign debt on the total of the public debt (around 60%). While Italy or Great Britain has this share relatively low (see Cabral 2010 or Roxburgh 2010). Unfortunately the Eurostat database does not provide information about the share of foreign debt on total public debt. It's necessary to use combination of data from databases of the Eurostat and the World Bank. Figure 1 illustrates the results.

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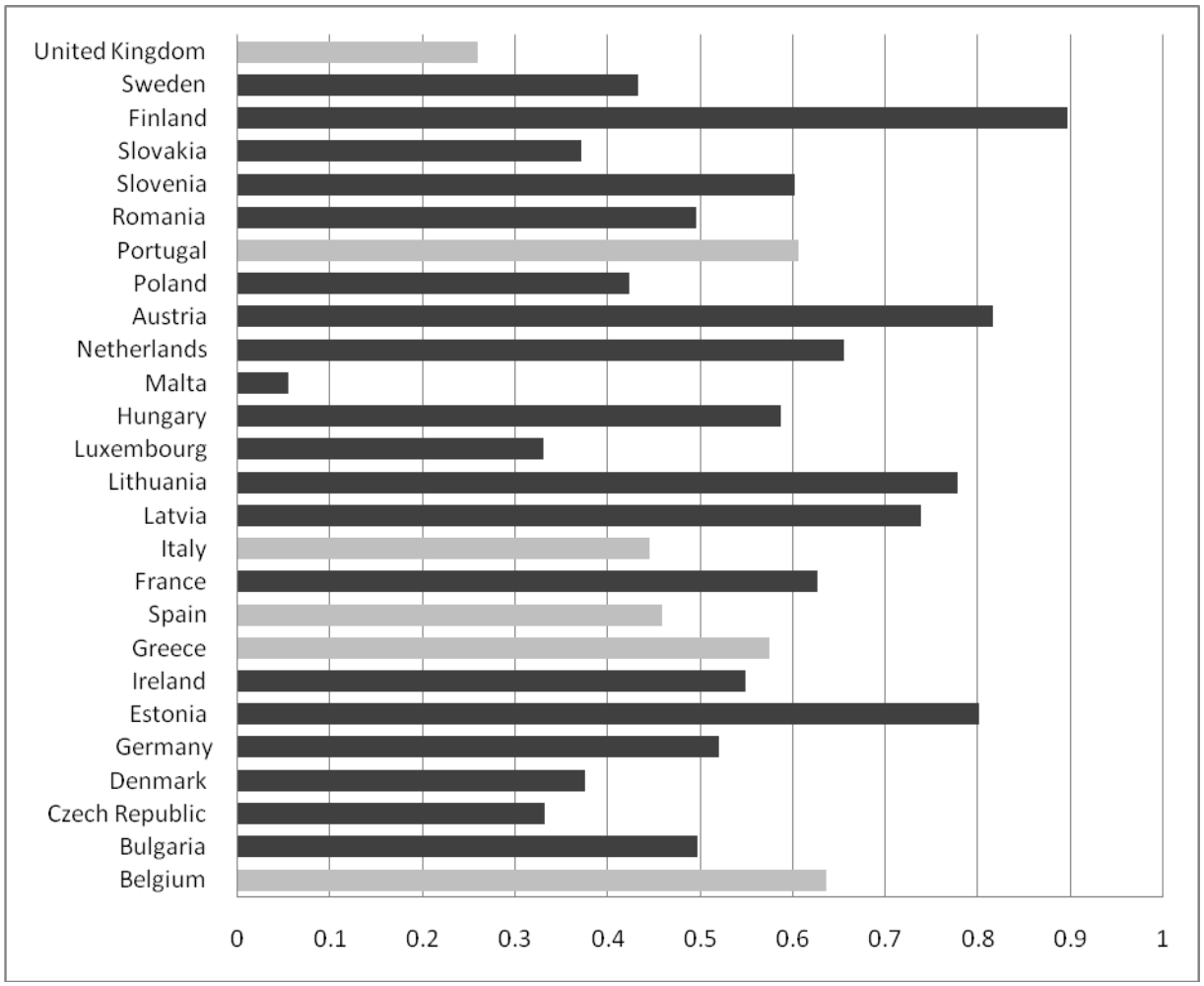
Figure 1: Foreign Debt ratio



Source: Eurostat, World Bank, own calculation

Out of countries selected by previous criteria Greece, Ireland and Portugal have relatively high shares of foreign debt. Although Italy has the foreign debt relatively lower we still consider it quite alarming. An interesting situation is in Belgium which has decreasing public debt trend but the Debt/GDP ratio is still one of the highest in the EU with considerably high share of foreign debt. We believe that Belgium is the next candidate for ranking decrease and subsequent public debt problems which the PIGS are facing now. The only advantage of Belgium is relatively high and stable GDP growth but it might be reverted in future especially if another world wide recession occurs.

3 Debt and Household Saving – The Barro-Ricardo Preposition

Besides the public debt issue it is necessary to pay attention to private and overall indebtedness as well. It is very interesting that economical experts, markets, media and even political representation are strictly focused on public debt. Private indebtedness or private savings are off the scope. High indebtedness of households or more precisely absence of savings of households could be no less fatal for the economy. The inability to service the debt was one of the basic triggers already mentioned mortgage crisis. There would not apparently be such harsh impact of mortgage bubble on financial sector if households have had enough reserves[2]. Clearly we should not blindly focus on public debt if we want responsibly analyze indebtedness of a country. We have to involve the private sector, especially households too.

At this point we are getting back to preposition of Barro - Ricardo mentioned above. The basic idea comes from classical economist David Ricarrdo. Robert Barro enhanced the original conception with microeconomic basis in seventies of last century. Simply the Barro - Ricardo hypothesis is saying that higher governments' expenditure do not affect the real

[2] As it was already mentioned in this paper the cornerstone of the problem were overestimated prices of real estate and mortgages incorporated into other financial means. Naturally these assets have been starting to lose their value when real estate's prices crashed. There was very tight connection between financial "packages" and their foundation - estates. The risk that households will not be able to pay for their mortgages and ipso facto banks will lose money started almost hysteria and very rapid drop of mentioned financial instruments. In other words the problem of these assets was not only connected to the drop of estates prices but mainly to the possibility of banks high loses. If we add into the mix the fact that lot of mortgages was so called subprime mortgages (loans for households with very small or negative savings) we can rationally expect completion of described scenario. The market was in the light of mentioned facts acting very unfavourably and the mortgage crisis has carried forward to the whole financial sector and into real economics. There would be probably different reception of the risks in case that referred household had adequate savings. For sure the "packages" would have lost a lot of their value but these would not be such expressive reaction from the market. Basically it would be only sectional drop of households' accounts

economy in any way. It is because households are acting rationally and in the expectation of higher taxation in future they accordingly increase their savings. So called Ricardian Equivalence hypothesis relays on equalizing of governments costs (or taxes) and private savings. In other words the higher is government spending the more household should save. Ricardo himself lately abandoned his own concept because the assumption of individuals acting rationally in the long term is just not realistic. There will be more likely the situation where the population starts living "on credit" for as long as possible. The burden of the debt finally lands on last generations. And we have to enunciate that many countries are now exactly in such position. The question is if these countries, i.e. households in these countries, have enough savings to cover the inevitable reduction in government spending and tax increase. In that case, there could be (under certain conditions) realistic hope for "internalization" of the debt, for devolution of the part of debt to households without substantially harmful effects on economy. We will use panel data of selected EU member states[3] in timeline from 2000 to 2009 for empirical verification of Barro-Ricardo hypothesis. We use the general government debt as a convenient proxy for public debt. The model has following general linear formula:

$$s_{it} = a + \alpha(g_{it}) \quad , \qquad (1)$$

where *s* is the saving ratio and *gd* represents the share of public debt on GDP in country *i* in time *t.* Unit root tests revealed integration of degree 1 of both series however Johansen cointegration test points at joint long time trend in series – there is one cointegration equation. Therefore taking first differences would probably result in losing the informative power and it is convenient to estimate the model in levels. All tests are in the Appendix. Estimated model is of following form

$$s_{it} = b_0 + b_1(g_{it}) + \varepsilon_{it} \quad , \qquad (2)$$

General least squares method was used for estimation of (2) utilizing SUR in periods[4]. We get (*t*-statistics in brackets, full representation is in Appendix)

[3] Unfortunately the data of some EU 27 member states are not available. Coincidentally they were Greece and Ireland - countries in the focus of our interest and further Luxemburg, Malta, Bulgaria, Romania and Slovenia.

[4] This method is also known as Parks´ estimator All estimates and tests in this paper are done in EViews software which distinguishes between coss-section SUR and period SUR. In both cases it uses GLS (general least

$$s_{it} = 2{,}66 + 0{,}145(g_{it}) \qquad (3)$$
$$(4{,}01)\ \ (13{,}15)$$

The R2 is relatively high (0,47) proving that Barro-Ricardo preposition is valid for the case of EU countries[5]. Although Ireland and Greece are missing the model shows that generally countries with high public debt tend to have high savings ratio of households. Therefore there is a possibility to fund the public debt from private savings. Of course there is a tricky question how to convince the households to do that. We may consider standard higher taxation or think of some other less convenient measures. But although the crash of public finance would have substantial effect on households it is very important to explain the households why the taxes must be raised. . It is also a question what will be the impact of tax increase on the economy. With high savings ratio households will probably not consume much less (they reduce savings instead) but private investment might decrease. If the investment decrease is massive then higher taxes will harm not help the economy to get out of the debt trap. This must be further investigated before government makes any steps towards tax increase or other anti debt measures.

Conclusion

The public debt issue is contemporary in focus of economists, politicians, media and public. It hunts especially European countries where high indebtedness of PIGS countries is threatening the whole region and the single currency area. Although the public debt level is important there are several other factors which increase the country´s riskiness to face the public finance bankrupt. First we have to focus on the public debt dynamics where Greece is for instance almost at the EU 27 average. The public debt has risen rapidly in last decade in Ireland or United Kingdom. Greece increased the debt substantially in 2009 in accordance to recession. However if we combine the level and dynamics of public debt we see that the PIGS countries really have the worst values followed by Belgium and United Kingdom. The only exception is Spain which does not have relatively high either the debt level or the debt dynamics. In spite

squares) method with correction of heteroskadisticity of residuals among cross sections or among periods. This correction is being used especially when the panel members are exposed to a joint exogenous shock which is resulting in correlation in residuals.

[5] Similar conclusion was obtained by Afonso (2008). He analyzed two periods – 1970-1991 (with no evidence) and 1992-2006 (with evidence of Barro-Ricardo preposition) focusing on consumption rather than savings. Also Seater (1993) finds the equivalence valid although according to him it might be substantially affected by relevant data and variables.

of this fact it is considered as risky – probably because of the geographical location in the problematic (PIG) region. On the other hand United Kingdom and Belgium are still considered as reliable – two other factors probably play important role here. First it is a belief that the countries have potential to service the debt which is connected to their stable long term growth. However this might revert if new world wide recession comes. The other factor is the share of foreign debt on total public debt. Naturally the higher is the foreign debt ratio the more concerned foreign investors are. Also the threat of the debt trap increases as the interest is being paid to non-residents which is hampering the economic growth. Out of our analysis it is again clear that the PIGS countries (again without Spain and slightly Italy) tend to have relatively higher share of foreign debt. United Kingdom has relatively very low share of foreign debt but Belgium is the opposite case – high debt level and high share of foreign debt is quite dangerous combination and we regard Belgium as the next possible risky state from the public debt point of view.

We have empirically proven that Barro-Ricardo preposition is valid for the case of European countries. Households tend to have higher saving ratio in those member states where the public debt to GDP ratio is high. However it is a question if this phenomenon can at least partially solve the problem of public debt. Truly there could be space for tax increase as households will probably save less but consumption might remain almost the same. On the other hand we are not aware of the impact on private investment. If raise in taxation reduces private investment substantially it might have eventually negative effect on public finance and public debt. Further research should be undertaken before the decision is made and any steps must be clearly explained to public because after all it will be the households who will pay.

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Appendix

Table 3: Unit root test (government debt)

Pool unit root test: Summary
Series: GD_BE, GD_CZ, GD_DE, GD_GE, GD_ES, GD_SP, GD_FR, GD_IT, GD_CY, GD_LA, GD_LT, GD_HU, GD_NE, GD_AT, GD_PL, GD_PG, GD_SK, GD_FI, GD_SW, GD_UK
Date: 08/13/11 Time: 23:41
Sample: 2000 2009
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic selection of lags based on SIC: 0 to 1
Newey-West bandwidth selection using Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.92356	0.8221	20	167
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.94461	0.8276	20	167
ADF - Fisher Chi-square	49.0164	0.1552	20	167
PP - Fisher Chi-square	20.6556	0.9951	20	180

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 4. Unit root test (household saving ratio)

Pool unit root test: Summary
Series: S_BE, S_CZ, S_DE, S_GE, S_ES, S_SP, S_FR, S_IT, S_CY, S_LA, S_LT, S_HU, S_NE, S_AT, S_PL, S_PG, S_SK, S_FI, S_SW, S_UK
Date: 08/13/11 Time: 23:42
Sample: 2000 2009
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic selection of lags based on SIC: 0 to 1
Newey-West bandwidth selection using Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.79235	0.0026	20	172
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.33454	0.0910	20	172
ADF - Fisher Chi-square	52.5294	0.0886	20	172
PP - Fisher Chi-square	37.0450	0.6040	20	180

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 5: Cointegration test

Johansen Fisher Panel Cointegration Test
Series: GD? S?
Date: 08/13/11 Time: 23:43
Sample: 2000 2009
Included observations: 10
Trend assumption: Linear deterministic trend
Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	248.8	0.0000	202.6	0.0000
At most 1	137.8	0.0000	137.8	0.0000

* Probabilities are computed using asymptotic Chi-square distribution.

Table 6: Barro-Ricardo preposition estimate, full representation

Dependent Variable: S?
Method: Pooled EGLS (Period SUR)
Date: 08/13/11 Time: 00:54
Sample: 2000 2009
Included observations: 10
Cross-sections included: 20
Total pool (balanced) observations: 200
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GD?	0.145889	0.011090	13.15508	0.0000
C	2.661906	0.663113	4.014259	0.0001

Weighted Statistics

R-squared	0.468299	Mean dependent var	0.484037
Adjusted R-squared	0.465613	S.D. dependent var	2.436310
S.E. of regression	0.996170	Sum squared resid	196.4862
F-statistic	174.3894	Durbin-Watson stat	1.982534
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.576112	Mean dependent var	9.710900
Sum squared resid	2339.368	Durbin-Watson stat	0.370138