Growth Forecast Errors and Government Investment and Consumption Multipliers*

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ABSTRACT

We compare government investment and consumption multipliers in developed economies during the recent fiscal consolidation. We find that, in highly-indebted countries, the investment multiplier is likely to be much higher than what has been assumed by policy makers and much higher than the consumption multiplier. This leads to the conclusion that the consolidation should be accompanied by increased public investment.

JEL classification: E62

Keywords: fiscal consolidation, fiscal multiplier, public consumption, public investment, public debt

I. Introduction

Developed economies are currently going through a fiscal consolidation. One of the main questions for developed countries is how to design the consolidation in order to reduce the damage it will have on growth (see Lagarde (2013)). To do that, activities with lower impact on growth should be reduced more than activities with a greater impact.

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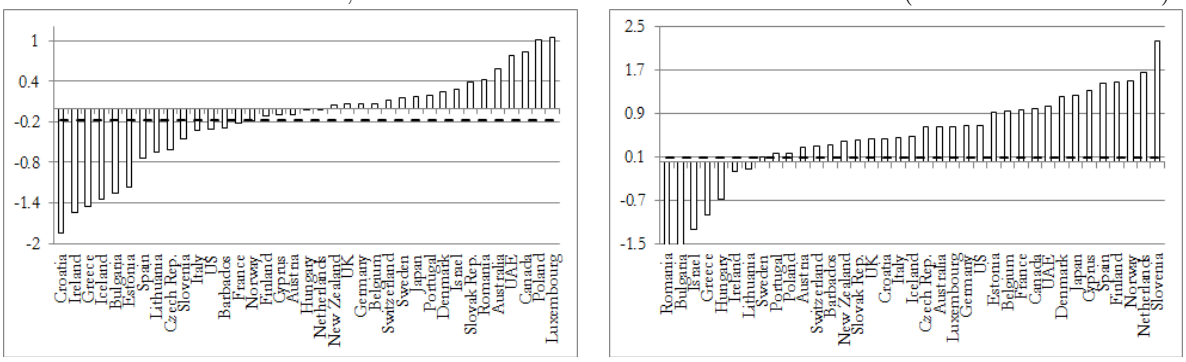
It is usually considered that government investment has a greater impact on growth (i.e., multiplier) than government consumption. For instance, the Golden Rule of public finance states that governments should borrow only for investment, not for consumption, since investment pays for itself, through the future tax revenues generated by the new capital stock (Perotti (2004)). Some economists have argued that the current fiscal consolidation should allow some support through public investment. Christina Romer, for instance, argues: *"There is simply no question that the United States needs to enact a comprehensive plan for long-term deficit reduction as soon as possible. But any such plan could and should include another substantial dose of fiscal expansion in the short run—ideally one oriented toward public investment."* (Romer (2012), p. 13). Similarly, Spilimbergo et al. (2008), when advising on the appropriate fiscal policy for the crisis, say: *"(...) spending programs, from repair and maintenance, to investment projects delayed, interrupted or rejected for lack of funding or macroeconomic considerations, can be (re)started quickly"* (Spilimbergo et al. (2008), p. 5).

Despite these recommendations, there is very scarce evidence that the government investment multiplier is higher than the government consumption multiplier in the distressed economies. Hence, it may not come as a surprise that the fiscal authorities in these countries have ignored these suggestions. As a result, investment spending has been cut more than consumption expenditure during the ongoing consolidation (see Figure 1). In Greece, for instance, public investment as a percentage of Gross Domestic Product (GDP) has been cut in 2010 and 2011 by 1.5 percentage points (relative to the previous three years), while public consumption has been cut by only 1 percentage point (p.p.). In Ireland, similarly, investment has been cut by 1.5 p.p., while consumption by only 0.2 p.p.. As a matter of fact, public investment in 37 developed economies that we analyse[1], has been cut, on average, by 0.2 p.p., while public consumption has been increased by 0.1 p.p.[2] (see section III on the data sources).

1. We analyse the countries that the World Bank classifies as high-income, plus the EU countries that are still low-income. See section III for more.

2. If the two outliers are excluded (Bulgaria and Romania, where consumption has fallen by 9 percent of GDP), the average increase in public consumption is even higher, 0.6 percent.

Figure 1: Change in government investment (left) and government consumption (right), as a percent of GDP, in 2010-2011 with respect to 2007-2009 (percentage points)



Source: Author's calculations, using data from Gwartney et al. (2012) and World Bank's World Development Indicators. The dashed lines are the averages for all the countries.

This paper will compare the government investment and the government consumption multiplier in the advanced economies during 2011 and 2012. The approach that will be used is similar to that of Blanchard and Leigh (2013) - growth forecast errors (the difference between realised and expected GDP growth) for 2011 and 2012 will be regressed on variables measuring government investment and government consumption during the previous years, 2010 and 2011. Since the forecasts should incorporate all the relevant information known at the time of their preparation, and the government consumption and investment for the previous year were known when the forecasts for the forthcoming year were prepared, the two should be uncorrelated if the right multipliers were used. If the coefficients on public consumption and investment turn out to be positive and significant, that would imply that the multipliers are higher than those that were assumed. The analysis will distinguish between the highly-indebted and the non-highly-indebted countries, due to the conventional understanding that the fiscal multiplier may be lower, or even negative, in times of high debt.

The results point out that the consumption multipliers have been neither higher nor lower than those assumed by the forecasters, both for the countries with high debt and for the countries with not-so-high debt; same for the investment multipliers in the non-highly-indebted countries. However, the investment multipliers in the highly-indebted countries seem to be substantially higher, by more than one, than those that were assumed in the forecasts. Assuming that the consumption and investment multipliers that were used in the forecasts are similar (a reasonable assumption, judging by Coenen et al. (2012), p. 46, Table 3), these results suggest that the investment multiplier is much higher than the consumption multiplier in the highly-indebted countries. Assuming that similar investment multipliers were used for the highly-indebted and the not-so-highly-indebted countries, these results

suggest that the investment multiplier is higher in the former than in the latter.

The finding that the investment multiplier is higher than the consumption multiplier reiterates one of the basic postulates of Keynesian economics - that public investment is the best way for the government to support the economy. Several explanations can be offered for the higher investment multiplier: public investment, besides the demand effects, has also supply side effects; public investment is less likely to crowd-out private demand, than public consumption; public investment is less likely to end up in imports or savings, compared to public consumption.

The finding that the investment multiplier is higher for the highly-indebted countries comes as a surprise, however, since it is usually believed that high debt reduces the multiplier, through the expectations effect (higher probability for a default in the future). We offer two explanations for this finding. First, it may happen that the highly-indebted countries have a low level of public capital (relative to the optimal level), which makes the return on public capital high (see Perotti (2004), for a similar explanation, though in the opposite direction). Indeed, the finding for the higher investment multiplier is driven by countries considered as having weak public infrastructure - Greece, Ireland and Italy. An alternative explanation is through an expectations effect, but in an opposite direction - if the public does not believe in austerity, i.e. expects the austerity to increase the public debt, instead of decreasing it (which may happen if it expects a high multiplier), the expectations effect may add up to the standard Keynesian effects. The possibility for this self-fulfilling outcome has recently been discussed by Blanchard, Mauro and Dell'Ariccia (2013) and IMF (2013*a*). Support for this explanation is found in existing studies on sovereign bonds dynamics, which find that markets value GDP growth more than reduction in fiscal deficit (see Caggiano and Greco (2011), EC (2012*b*), Romer (2012)).

The strong interpretation of these findings is that by increasing government investment and cutting government consumption more than proportionately, policy makers can achieve two goals at the same time - reduce the deficits and support the economy. The weak interpretation is that public investment should be the last on the list for cutting during a consolidation.

The rest of the paper is structured as follows. Section II discusses the related literature, and section III describes the methodology and the data. Section IV presents the basic results as well as some robustness checks. Section V discusses the findings and section VI concludes.

II. Related literature

Keynesian economics considers public investment as the most effective fiscal policy instrument - it combines the short-run support of the government consumption with the long-term supply-side benefits (see Skidelsky (2001)). The Golden Rule of fiscal policy follows the same logic, and argues that government investment can be financed by new debt, unlike government consumption, since it will pay for itself, by the tax revenues from the new capital stock. However, there has been very weak evidence in support of the claims that the government investment is more effective for growth than government consumption in the developed countries, in the period preceding the crisis. On the contrary, Perotti (2004) shows that neither the short-run, nor the long-run multipliers from the government investment spending are higher than the multipliers from government consumption, in five developed countries (US, UK, Canada, Germany and Australia). His explanation for this finding is that developed countries have a high level of public capital, which makes its marginal product low. Similarly, models used by leading world institutions assume similar multipliers from public investment and public consumption. Coenen et al. (2012) compare the effects of different forms of fiscal stimulus using seven Dynamic Stochastic General Equilibrium (DSGE) models used by leading policy-making institutions, including the International Monetary Fund (IMF). They find that the government investment spending has stronger effects on the GDP than the government consumption, but only marginally (see Table 3, p. 46).

The vast literature on fiscal multipliers that has appeared during the crisis has not overlooked this issue entirely. Eggertsson (2011) analyses which fiscal policy is likely to be effective in the current situation, with zero lower bound and insufficient demand, using a DSGE model. He finds that a temporary increase in government spending targeted at goods which are imperfect substitutes with private consumption, like public infrastructure, is one of the most effective measures. Auerbach and Gorodnichenko (2012*b*) compare the consumption and investment multipliers in the US, using a Smooth Transition Vector Autoregression that allows the multipliers to differ in recessions and expansions. They find that the investment multiplier is much higher than the consumption multiplier, particularly in recessions (the cumulative investment multiplier in recessions is 4.3, while the corresponding consumption multiplier is 1.3). They also find that the multipliers, in general, are likely to be much larger in recessions than in expansions.

The dependence of the multiplier on the state of the business cycle has been analysed by other researchers, too, like Batini, Callegari and Melina (2012), Baum, Poplawski-Ribeiro and Weber (2012)

and Caprioli and Momigliano (2013). All these papers apply a similar technique (regime-switching Vector Autoregression) and arrive at similar conclusions - that the multipliers are likely to be greater when the economy is in a downturn. The explanation is that in recessions, government spending is less likely to crowd-out private spending.

Another strand of literature has investigated the relationship between the fiscal multiplier and the level of the public debt. The conventional wisdom argues that with a high level of public debt the multiplier is likely to be lower, since the positive demand effects are offset by negative expectations effect. Government spending increases the probability for a future tax hike, when the debt is high, which reduces expected lifetime income, and hence - output. The recent literature investigating this relation unanimously finds that the level of debt reduces the multiplier; see Auerbach and Gorodnichenko (2012*a*), Ilzetzki, Mendoza and Vegh (2010), Kirchner, Cimadomo and Hauptmeier (2010), Nickel and Tudyka (2013), and Rusnak (2011).

Because the current situation in most of the advanced economies is characterised both by a depressed economy with zero interest rates and high public debt, it is not straightforward to assess the size of the current multipliers, since the first attribute pushes for high multipliers, while the second for low. Blanchard and Leigh (2013) investigate whether the multipliers that have been used by the IMF and other professional forecasters recently have been correct or not. They use a simple, yet very smart proposition - if the multipliers have been correct, there should be no correlation between the growth forecast errors (the difference between the realised and forecasted GDP growth) and the planned fiscal policy measures, since the planned measures have been taken into account when the forecasts have been prepared. Thus, by regressing the growth forecast errors on the planned fiscal consolidation, one can assess whether the models that have been used for the forecasts are correct or not. If one finds significant coefficients for the planned consolidation, then that would imply that the multipliers "assumed"[3] in the models are incorrect. That is what Blanchard and Leigh (2013) find - that the models have underestimated the multipliers, i.e. that the multipliers in the advanced countries in the current situation are likely to be high.

3. Since the forecasts from the models are a result of many different factors, it is not entirely correct to speak about certain values of multipliers assumed in the models. We will, nevertheless, use this word, for ease of exposition.

III. Methodology and data

The methodology that is used in this paper is a modified version of the approach by Blanchard and Leigh (2013) and is based on regressing the growth forecast errors in a given year on variables measuring fiscal policy during the previous year. If the multipliers that were used for producing the forecasts are correct, the growth forecast errors should be uncorrelated with government spending from the previous year, since these data were known when the forecasts were prepared. Hence, a regression of the growth forecast errors for year t on variables measuring fiscal decisions made during year $t-1$ should produce insignificant coefficients. If the coefficients turn out to be significant, that would indicate that the effect of the fiscal decisions on the growth has been either overestimated (if the coefficients are negative) or underestimated (if the coefficients are positive).

We extend the analysis of Blanchard and Leigh (2013) in two ways. First, instead of using a measure of the overall fiscal stance, we will distinguish between government consumption and government investment, in order to evaluate the proposals for supporting the economy through public spending[4]. Second, we will allow the multipliers to differ for the highly indebted countries, given the widespread belief that the multipliers are lower, or even negative, when the debt is high. Therefore, our basic regression will be:

$$\begin{aligned} &\textit{Forecast Error of GDP Growth}_{t,i} = \beta_0 + \beta_1 * \textit{Government Consumption}_{t-1,i} \\ &+\beta_2 * \textit{Government Investment}_{t-1,i} + \beta_3 * \textit{Government Consumption}_{t-1,i} * \textit{High Public Debt}_{t-1,i} \\ &+\beta_4 * \textit{Government Investment}_{t-1,i} * \textit{High Public Debt}_{t-1,i} + \epsilon_{t,i} \end{aligned}$$

where the subscript t indexes the years 2011 and 2012 and i indexes the countries. The analysis will be done on a sample of *developed* countries, since it is these countries that are going through fiscal consolidation. To end up with as many observations as possible, we select the countries that the World Bank classifies as high income economies, plus the EU countries that are still not high income, on which there are the required data. As will become clear, results are almost identical when various versions of restricted samples (like the advanced economies of the IMF) are used. Hence, the following 37 countries are included: Australia, Austria, Barbados, Belgium, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Lithuania, Luxembourg, Netherlands, New Zealand, Norway,

4. The third component of public spending, the public transfers, are excluded from the analysis, due to data unavailability.

Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom, United States. Since certain data is unavailable for 2012, 62 observations in total will be analysed. This may seem low, but it should be noted that similar studies work with an even lower number of observations (e.g., the baseline regression of Blanchard and Leigh (2013) is estimated on 26 observations).

The forecast errors for the GDP growth are calculated as a difference between the realised real GDP growth in year t (2011 and 2012) and the projected growth for that year at the beginning of year t. Projected GDP growth is taken from the April editions of the World Economic Outlook (WEO) in year t, i.e. 2011 and 2012 (IMF (2011) and IMF (2012)). These projections are prepared at the beginning of the year, when all the relevant data for the previous year are known, including the fiscal stimulus, but economic growth for the current year is still unknown. GDP growth and public debt is from the April 2013 edition of the WEO (IMF (2013*b*)).

Government consumption is defined as the difference between the government consumption in year $t-1$ (2010 and 2011) and the average government consumption for 2007-2009. Government investment is defined analogously. We take the difference from the average for the period 2007-2009, instead of from a value for a single year (e.g. 2009), to avoid potential base effects - since GDP in 2009 in many of these countries was lower than usual, due to the recession, the share of government consumption and investment in GDP may have been higher than usual in 2009, which may overestimate the fiscal contraction in 2010 and 2011.

High public debt is a dummy variable which takes value of one for countries with *gross*[5] public debt above 95% of GDP in year $t-1$ (2010 and 2011). Five countries have debt above 95% in 2010: Belgium, Greece, Italy, Japan and US, and three more in 2011 - Iceland, Ireland and Portugal. The 95% threshold is chosen after Baum, Checherita-Westphal and Rother (2013). All in all, 11 of the 62 observations can be classified as "high debt" episodes (Iceland and Ireland drop out due to unavailability of data on GDP growth for 2012 in the April 2013 WEO).

Data on government consumption are from the World Development Indicators (WDI) database of the World Bank. Data on government investment are calculated from Gwartney, Lawson and Hall (2013*a*), who, in their Economic Freedom of the World database, provide data on government investment as a share of total investment for about 130 countries. The sources of the government investment data in this database are: Government Finance Statistics Yearbook of the IMF; WDI

5. We take the gross debt, instead of the net, since the latter is available for fewer countries.

of the World Bank; International Finance Statistics of the IMF; World Economic Forum, Global Competitiveness Report; United Nations National Accounts; and Transition Indicators of European Bank for Reconstruction and Development (see Gwartney, Lawson and Hall (2013*b*) p. 236). These values are then multiplied with the share of gross fixed capital formation in the GDP, from WDI.

IV. Results

The results of the main regression are presented in Table 1, column 1. All the variables in the regression are insignificant, except the cross-product of the high debt dummy and the government investment, which is significant at the 1% level. The insignificance of the government consumption and government investment variables points out that the multipliers implied in the forecasts are unlikely to differ from the actual ones, for the countries without high debt. The insignificance of the cross product of the government consumption with the high debt dummy indicates that there are likely no differences between the consumption multipliers for the highly-indebted and the non-highly-indebted countries, assuming that similar multipliers were used for them in the forecasts. On the other hand, the cross-product of the high debt dummy and the government investment is significant at the 1% level. The sum of this coefficient with the government investment coefficient gives the difference between the investment multiplier implied in the forecasts and the actual one, for the countries with high debt. The sum is significant at the 1% level, again, indicating that the actual investment multiplier for the highly indebted countries is likely to be higher than the one used in the forecasts by around 1.7. Assuming that similar investment multipliers were used for the highly-indebted and the non-highly-indebted countries, this suggests that the investment multiplier is higher for the indebted countries. Furthermore, if the impact of government consumption and investment on GDP was assumed to be similar in the indebted countries, this implies that the investment multiplier is likely to be higher than the consumption multiplier in these countries. Evidence from Coenen et al. (2012) suggest that this is likely to be the case - they examine the growth effects of government consumption and investment in the main workhorse models of the leading policy institutions in the world, finding that the investment multiplier is only marginally higher than the consumption multiplier.

In the next two columns of Table 1, we check whether the results change if the sample of countries is changed. In column 2, we estimate the regression for the group of countries that the World Bank classifies as high income (i.e. we exclude the EU countries which are still low income). In this way,

we lose 6 observations, compared to the initial regression. In column 3, we restrict the sample to the countries that the IMF classifies as advanced, losing 6 additional observations. As can be seen, the results remain very similar - the cross product of the high debt and the government investment is always significant at one percent, as well as its sum with the government investment. Therefore, we continue the analysis with the initial group of countries, due to the highest number of observations in this case.

We next explore the possibility that our results are driven by certain outliers. In column 4, we estimate the equation using quantile regression, which uses the median of the variables, instead of the mean. In column 5, we estimate the equation using the robust regression technique of Andersen (2008). The variable of interest has a slightly lower coefficient in these two regressions, but remains significant (at the 5% level). In column 6, we bootstrap the standard errors in the baseline regression, due to the small sample size[6]. The variable of interest remains significant, though only at the 10% level.

Table 1: Baseline results and some sensitivity analysis

	-1 Baseline	-2 High income economies	-3 Advanced economies	-4 Quantile regression	-5 Robust regression	-6 Bootstrapped st. errors
Government consumption	0.04	-0.06	-0.32	0.06	0.01	0.04
	(0.48)	(0.80)	(0.13)	(0.25)	(0.85)	(0.59)
Government investment	-0.34	-0.36	-1.01***	-0.33	-0.12	-0.34
	(0.14)	(0.16)	(0.00)	(0.11)	(0.53)	(0.33)
Government consumption	-0.53	-0.45	-0.38	-0.29	-0.28	-0.53
*High public debt	(0.23)	(0.31)	(0.33)	(0.47)	(0.45)	(0.17)
Government investment	2.06***	2.11***	3.05***	1.40***	1.17**	2.06*
*High public debt	(0.00)	(0.00)	(0.00)	(0.01)	(0.03)	(0.06)
Constant	-0.05	-0.03	0.18	-0.08	-0.16	
	(0.74)	(0.91)	(0.40)	(0.56)	(0.23)	
Observations	62	56	50	62	62	62
R-squared	0.17	0.17	0.36		0.08	
Gov. inv.*High pub. debt	1.72***	1.75***	2.04***	1.07**	1.05**	1.72*
+ Gov. inv.	(0.00)	(0.00)	(0.00)	(0.02)	(0.04)	(0.09)

Dependent variable in all regressions is the growth forecast error.

p-values in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively.

6. The bootstrapping exercise was done using 3000 replications. Higher number of replications gave similar results. The seed used for the simulation in Stata was 26011982, the date of birth of the author.

Next, we add certain controls in the baseline regression. It is possible that certain factors, correlated with the growth forecast error and the fiscal support, may be driving the results, like some factors that push for expansionary fiscal policy and higher than expected growth at the same time. By including additional controls, we also, in a certain way, control for possible errors in the forecasts regarding the effects of the other variables on the GDP. We start by adding the trade and financial flows experienced in year t (exports, FDI and portfolio flows; see Table 8 in the appendix for a definition of these variables and the other variables from this section). Unexpected flows, caused by fiscal decision from the previous year, may bias the results. Column 2 of Table 2 shows these results. They are almost the same as the baseline. In column 3, we add the monetary policy stimulus during year $t-1$, by including the interest rate and the expansion of the M1. If both the monetary and fiscal policy are expansionary, and the forecasters have underestimated the effect of the monetary policy on growth, then the significance of the fiscal variables may be capturing the effect of the monetary policy. This does not seem to be the case, since the monetary policy variables are insignificant and the fiscal policy variables remain unchanged. In column 4, we add certain variables for the banking system - the share of capital in the total assets and the share of non-performing loans in year $t-1$. These variables are likely to be correlated with the fiscal policy, due to the bank bailouts, for instance, and if their effect on GDP growth has not been well accounted for, then the significance of the fiscal variables may be due to their omission. Again, this does not seem to be the case. Next, we include the level of public debt and the fiscal balance in year $t-1$ - high debt (or deficit) may be correlated with the fiscal policy, and is likely to affect growth, too. The results remain unchanged, again. Next, we include the current account balance - external imbalance may be related to fiscal policy (twin deficits) and may affect growth at the same time. However, the results remain stable once again.

The fiscal decisions may be endogenous with respect to the growth forecast errors through another channel - through political factors. Certain factors of political nature may lead to lower than expected GDP growth and may be correlated with the fiscal decisions from the previous year. For instance, political instability, or inability to reach agreement in the parliament, are likely to affect the size of the stimulus/consolidation, as well as its design (the allocation between consumption and investment). They may also lead to lower growth than initially expected. To control for this, we add several variables capturing certain political characteristics. We include: 1) a dummy for coalition governments - coalition governments are more difficult to reach an agreement for decisive cuts in government spending; 2) a dummy for control of all the relevant houses - if the party in power has control of

all the relevant houses, it can implement problematic cuts or reforms more easily; 3) the share of seats in the parliament belonging to the government parties - the bigger the share of seats in the parliament belonging to the government parties, the more easily the government will make politically problematic decisions; 4) a dummy for left orientation of the government - parties on the left of the political spectrum may be more reluctant to cuts in government spending. These data are taken from the Database of Political Institutions 2012 of Beck et al. (2001). The results are presented in column 7 of Table 2. As can be seen, the variable of interest remains significant, though only at 10%.

Table 2: Additional controls

	-1 Baseline	-2 Trade and finance	-3 Monetary	-4 Banking	-5 Fiscal distress	-6 External	-7 Political variables
Government consumption	0.04	0.05	0.11	0.07	0.01	0.03	0.07
	(0.48)	(0.46)	(0.22)	(0.27)	(0.87)	(0.55)	(0.23)
Government investment	-0.34	-0.05	-0.68**	-0.32	-0.15	-0.34	-0.37
	(0.14)	(0.85)	(0.02)	(0.19)	(0.44)	(0.14)	(0.12)
Government consumption	-0.53	-0.62	-0.52	-0.99*	-0.24	-0.52	-0.45
*High public debt	(0.23)	(0.22)	(0.25)	(0.09)	(0.60)	(0.24)	(0.36)
Government investment	2.06***	1.84***	2.27***	2.14***	1.49**	1.93***	1.55**
*High public debt	(0.00)	(0.01)	(0.00)	(0.00)	(0.03)	(0.01)	(0.03)
Exports		0.11***					
		(0.00)					
FDI		0.00					
		(0.90)					
Portfolio flows		0.01					
		(0.50)					
Monetary aggregate M1			0.00				
			(1.00)				
Interest rate			0.03				
			(0.79)				
Capital adequacy				0.14**			
				(0.03)			
Non-performing loans				-0.03			
				(0.33)			
Public debt					-0.00		
					(0.68)		
Budget balance					0.00		
					(0.97)		
Current account balance						0.02	
						(0.53)	
Left government							-0.40
							(0.30)
All houses							-0.44
							(0.27)
Coalition government							-0.14
							(0.75)
Share of parliament seats							1.30
							(0.44)
Constant	-0.05	-0.54**	-0.10	-0.92**	-0.07	-0.06	-0.51
	(0.74)	(0.02)	(0.74)	(0.04)	(0.80)	(0.72)	(0.63)
Observations	62	50	48	54	58	62	62
R-squared	0.17	0.46	0.27	0.26	0.20	0.17	0.22
Gov. inv.*High pub. debt	1.72***	1.79***	1.59**	1.82***	1.34**	1.59**	1.17*
+Gov. inv.	(0.00)	(0.00)	(0.02)	(0.01)	(0.04)	(0.01)	(0.09)

Dependent variable in all regressions is the growth forecast error.
p-values in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively

In order to see if the results are driven by certain countries, we next do a simulation in which we randomly discard twelve observations (20% of the sample), and reestimate the baseline regression on

the remaining 50 observations.[7] We repeat this exercise six times. The results, shown in Table 3, yield additional support to our findings.

Table 3: Randomly discarding 20 percent of the sample

	-1	-2	-3	-4	-5	-6
Government consumption	0.03	0.04	0.11	0.06	0.04	0.11
	(0.70)	(0.53)	(0.25)	(0.29)	(0.56)	(0.25)
Government investment	-0.29	-0.49*	-0.56*	-0.55**	-0.28	-0.39
	(0.26)	(0.05)	(0.09)	(0.05)	(0.27)	(0.14)
Government consumption	-0.56	-0.89	-0.53	-0.90*	-0.61	-0.54
*High public debt	(0.27)	(0.15)	(0.26)	(0.08)	(0.27)	(0.31)
Government investment	2.92***	2.74***	2.18***	2.79***	2.08***	2.08***
*High public debt	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.07	-0.07	-0.13	0.05	-0.04	-0.08
	(0.72)	(0.68)	(0.49)	(0.77)	(0.81)	(0.67)
Observations	50	50	50	50	50	50
R-squared	0.18	0.25	0.19	0.27	0.17	0.20
Gov. inv + Gov. inv.*High pub. debt	2.63***	2.25***	1.62**	2.24***	1.80***	1.69**
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)

Dependent variable in all regressions is the growth forecast error.

p-values in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively.

As yet another check, we estimate the baseline regression eliminating each of the countries one by one. Table 4 presents these results. As can be seen, the coefficient of interest is always highly significant (p-value around 0.01) and with a similar magnitude as in the baseline regression (around 1.7), except in the case when Greece is excluded, when it becomes insignificant. Being at the heart of the sovereign debt crisis, it is not strange to find that Greece drives the results. The growth forecast errors for Greece have been much higher than for any other country. In addition, two of the eleven high-debt observations belong to Greece. Because of this, we believe that it would be incorrect to exclude Greece from the analysis.

7. The seed that was used for generating the random samples in Stata is 26011982.

Table 4: Elimating countries one by one

Country excluded	Coefficient	p-value	Country excluded	Coefficient	p-value
Australia	1.71	0.01	Italy	1.79	0.01
Austria	1.72	0.01	Japan	1.67	0.01
Barbados	1.76	0.00	Lithuania	1.65	0.01
Belgium	1.78	0.01	Luxembourg	1.75	0.00
Bulgaria	1.77	0.00	Netherlands	1.73	0.01
Cada	1.71	0.01	New Zealand	1.7	0.01
Croatia	1.77	0.00	Norway	1.73	0.00
Cyprus	1.75	0.00	Poland	1.7	0.01
Czech Rep.	1.72	0.01	Portugal	1.71	0.01
Denmark	1.77	0.00	Romania	1.68	0.01
Estonia	1.57	0.00	Slovak Rep.	1.74	0.01
Finland	1.75	0.00	Slovenia	1.76	0.00
France	1.73	0.01	Spain	1.73	0.01
Germany	1.69	0.01	Sweden	1.71	0.01
Greece	**0.03**	**0.98**	Switzerland	1.72	0.01
Hungary	1.75	0.00	UAE	1.64	0.01
Iceland	1.72	0.01	UK	1.75	0.00
Ireland	1.71	0.01	US	2.04	0.00
Israel	1.67	0.01			

Note: The table presents the coefficient of interest (gov.inv + high debt*gov.inv.) and its p-value when the baseline regression is estimated excluding each of the countries, one by one.

As an additional robustness check, we do a Bayesian Model Averaging (BMA) exercise, by which we try to see which of the discussed explanatory variables is likely to be the most robust determinant of the growth forecast errors. BMA is appropriate for situations when a large number of candidate explanatory variables exists, and the researcher does not know a priori what the correct theoretical model is. It estimates all the possible model combinations, using Bayesian techniques, weights them according to their goodness of fit, and calculates the weighted average for every variable. Inference in BMA is normally based on the Posterior Inclusion Probability (PIP), which is the probability that the variable is a robust determinant of the dependent variable. For a thorough elaboration of BMA, see Hoeting et al. (1999), or for a short applied exposition, see Jovanovic (2012). The BMA results are shown in Table 5. We use four different priors for the model coefficients (benchmark prior, unit information prior (UIP), hyper prior, and empirical Bayes local prior (EBL)[8]). For the model size,

8. The benchmark prior has been proposed by Fernandez, Ley and Steel (2001), the UIP prior by Kass and Wasserman (1995), the EBL prior by Hansen and Yu (2001), and the hyper prior by Liang et al. (2008).

we use the dilution prior suggested by Durlauf, Kourtellos and Tan (2008), which is an extension of the dilution prior proposed by George (1999). This prior is used in situations when multicollinearity may be a problem (see Feldkircher (2012), for example), because it penalises models which include variables with high correlation. We use this prior because three pairs of variables appeared highly collinear in our case, with correlation exceeding 0.7 (see Table 9 in the appendix). It should be noted that very similar results are obtained with other model priors. Each column of Table 5 presents results obtained with one of the model coefficients prior. All the results are based on the 500 best models. For clarity, we will present only the PIPs, the other statistics are available upon request.[9]

Table 5: Results of the BMA analysis

	hyper	UIP	BRIC	EBL
Exports	0.98*	0.94*	0.79*	0.99*
Government investment * High public debt	0.94*	0.9*	0.78*	0.97*
Government consumption	0.25	0.17	0.07	0.28
Capital adequacy	0.24	0.16	0.06	0.26
All houses	0.20	0.17	0.12	0.21
Portfolio flows	0.20	0.13	0.06	0.22
Budget balance	0.17	0.13	0.07	0.18
Government consumption * High public debt	0.15	0.12	0.07	0.15
Left government	0.14	0.10	0.05	0.15
Current account balance	0.14	0.10	0.04	0.16
Interest rate	0.12	0.08	0.04	0.13
FDI	0.11	0.08	0.04	0.12
Monetary aggregate M1	0.11	0.08	0.04	0.12
Share of parliament seats	0.10	0.07	0.04	0.11
Coalition government	0.1	0.08	0.05	0.11
Public debt	0.08	0.07	0.06	0.08
Non-performing loans	0.08	0.06	0.04	0.08
Government investment	0.06	0.06	0.04	0.06

The figures in the table are the Posterior Inclusion Probabilites (PIP).

* indicates variables with PIP above 0.5 (significant variables).

The only two significant variables in all the estimations are the exports and the cross product of the high debt dummy and the government investment. Therefore, it can be said that the results

9. The BMA analysis has been implemented in R, using the BMS library, developed by Feldkircher and Zeugner (2009).

of the BMA analysis confirm the previous findings, that the government investment is likely to be a significant determinant for the explanation of the growth forecast error in the indebted countries.

We also check whether the results hold when the IMF forecasts are replaced with forecasts from other institutions. Table 6, column 1 shows the results with forecasts from the European Commission, while column 2 shows the results when the forecasts from Consensus Economics are used.[10] The findings for the public investment remain as before. We also check if the correlation between the forecast errors and public investment is a rule rather than an exception. Column 3 of Table 6 shows the results of the baseline regression for *developing* countries, while column 4 shows the results of the regression for *developed* countries, but during "*good times*", i.e. for the period before the financial crisis (2007 and 2008). As can be seen, all the fiscal variables are insignificant in these two regressions, pointing out that the IMF forecast errors are likely to be random, normally, and that the correlation between the public investment and the growth forecast errors is present only for the developed countries, during the consolidation. Last, we replace the growth forecast errors with the GDP growth, and add the forecasted GDP growth as an additional regressor (column 5, Table 6). The forecasted GDP appears highly significant, with a coefficient of 1.16, indicating that the realised GDP is indeed correlated with the forecasts. The variable of interest retains its magnitude, but loses the significance (the p-value is 0.12), which can be attributed to its correlation with the additional regressor.

10. The spring forecasts from the European Commission are used EC (2011) and EC (2012*a*)), and the April editions of the Consensus Economics forecasts for G7 and Western Europe and Eastern Europe (ConsensusEconomics (2011*a*), ConsensusEconomics (2011*b*), ConsensusEconomics (2012*a*), ConsensusEconomics (2012*b*)).

Table 6: Other forecasts, periods and countries

	-1 European Commission	-2 Consensus Forecasts	-3 Developing, during consolidation	-4 Developed, before consolidation	-5 GDP growth as a dependent variable
Government consumption	0.02	0.02	0.30	0.19	0.04
	(0.66)	(0.66)	(0.19)	(0.12)	(0.48)
Government investment	-0.49**	-0.43*	-0.17	0.23	-0.41*
	(0.02)	(0.08)	(0.33)	(0.15)	(0.08)
Government consumption	-0.39	-0.49	0.50	-1.93	-0.52
*High public debt	(0.29)	(0.23)	(0.72)	(0.40)	(0.23)
Government investment	2.05***	1.88***	1.29	-0.08	1.51**
*High public debt	(0.00)	(0.00)	(0.47)	(0.91)	(0.04)
Forecasted GDP growth					1.16***
					(0.00)
Constant	-0.10	-0.07	-0.44*	-0.09	-0.34
	(0.46)	(0.66)	(0.08)	(0.71)	(0.16)
Observations	58	55	67	70	62
R-squared	0.24	0.18	0.07	0.10	0.81
Gov. inv.*High pub. debt	1.56***	1.44**	1.12	0.16	1.10
+Gov. inv	(0.00)	(0.01)	(0.53)	(0.80)	(0.12)

Dependent variable in the first four regressions is the growth forecast error, in the fifth, it is the GDP growth. p-values in parentheses. ***, ** and * denote significance at 1%, 5

V. Discussion

Two main messages should be taken from this analysis. The first one is that public investment is likely to have a bigger impact on GDP in the indebted countries, than public consumption. Our study is not the only recent study to suggest that the investment multiplier is likely to be higher than the consumption multiplier - Auerbach and Gorodnichenko (2012*b*) also find that the investment multiplier is much larger than the consumption multiplier (for example, in recessions, their consumption multiplier is 1.4, while the investment multiplier is 4.3). This finding is by no means novel, and can be explained in several ways. The first explanation is through the supply-side effects - public investment, in addition to the main demand effect, increases the capital stock, i.e. the potential GDP. However, this effect is unlikely to be the main driving force behind our results, since this effect primarily refers to the long run. A second explanation may be the smaller crowding out of the government

investment. Government investment is usually focused on goods which are imperfect substitutes with private consumption, therefore, they are unlikely to crowd out private expenditure (see Eggertsson (2011), for instance). Third, public investment has fewer "leakages" than public consumption - it is more labour-intensive, so less likely to end up in imports than public consumption (see Spilimbergo, Symansky and Schindler (2009), p. 2-3).

The second message from the analysis is that, contrary to the widespread belief, the (investment) multiplier is likely to be higher in the highly-indebted countries, than in the not-highly-indebted ones. We propose two possible explanations. . The first one is that the indebted countries may have, at the same time, a low level of public capital (relative to the optimal level), as a result of which its marginal product is high. Similar logic, though in the opposite direction, is proposed by Perotti (2004), in his findings that the investment multiplier does not differ from the consumption multiplier in the US, UK, Canada, Germany and Australia (the argument there is that these countries may have too high a level of capital, which makes the investment multiplier low).

To check how likely this explanation is, we divide the highly-indebted countries in our sample into two groups: countries with a high level of public capital and countries with a low level of public capital. We use the quality of overall infrastructure from the Executive Opinion Survey of the Global Competitiveness Report as a proxy for public capital (WEF (2011), p. 412). In particular, in the high public capital group, we include Iceland, Portugal, Japan, Belgium and the US, while in the low capital group - Ireland, Greece and Italy.[11] Then, we estimate the baseline regression, restricting the sample of high-debt countries only to those with high-capital (Table 7, column 2), and only to those with low-capital (Table 7, column 3). It can be seen that when only the high-capital high-debt countries are included, we no longer find evidence that the multipliers differ. On the other hand, when the low-capital high-debt countries are included, our previous findings regarding the higher investment multiplier in the highly-indebted countries remain. Hence, we may say that the explanation for the higher investment multiplier in the indebted-countries through the low public capital, and, consequently high marginal product on it, is supported by the data.

11. The index covers three aspects of the infrastructure - transport, telephony and energy. It covers around 140 countries. The highest possible value of the index is 7, the lowest 1. The average value of the index in 2010-11 for the whole world is 4.3. However, as only Italy has a value lower than this average, we choose 5 as the cut-off point for high vs. low public capital. The US, the lowest ranked high-capital country has a value of 5.7 and is ranked 24th in the world. Ireland, the highest ranked low-capital country, has a value of 4.6 and is ranked 53rd.

Table 7: Checking the public capital explanation

	-1	-2	-3
	Baseline	Excluding high-debt, low-public capital countries	Excluding high-debt, high-public capital countries
Government consumption	0.04	0.04	0.04
	(0.48)	(0.49)	(0.50)
Government investment	-0.34	-0.31	-0.34
	(0.14)	(0.17)	(0.17)
Government consumption	-0.53	-0.38	-0.47
*High public debt	(0.23)	(0.41)	(0.49)
Government investment	2.06***	-0.08	2.29***
*High public debt	(0.00)	(0.96)	(0.00)
Constant	-0.05	-0.07	-0.04
	(0.74)	(0.64)	(0.79)
Observations	62	57	55
R-squared	0.17	0.06	0.19
Gov. inv. + Gov. inv.*High pub. debt	1.72***	-0.40	1.95***
	(0.00)	(0.79)	(0.00)

Dependent variable in all regressions is the growth forecast error.

p-values in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively

Another explanation for the higher investment multiplier in the highly-indebted countries is through the confidence effects. Confidence effects are usually used to justify non-Keynesian effects of fiscal expansion and are the basis of "the German view" on fiscal policy (Giavazzi and Pagano (1990), p. 76). Hellwig and Neumann (1987), p.137-138, for instance, say: *"The direct demand impact of slower public expenditure growth is clearly negative. (...) The indirect effect on aggregate demand of the initial reduction in expenditure growth occurs through an improvement in expectations if the measures taken are understood to be part of a credible medium-term program of consolidation"* (see also Fels and Froehlich (1987)). Blanchard (1990) proposes a model in which fiscal consolidation increases consumption. The idea is that by undertaking consolidation today, the government eliminates the need for larger, probably more disruptive consolidation in the future, which increases the expected lifetime income of households, and hence consumption. Baxter and King (1993) analyse, through a model, under which circumstances fiscal expansions can produce a negative response in economic activity, finding that this is likely to happen when the expansion is financed by taxes, since they increase the expected future tax burden. Sutherland (1997) and Perotti (1999) develop models in which

fiscal policy has standard, Keynesian effects under low debt, but switches to non-standard effects as the level of debt becomes high.[12] What all these models have in common is that the non-standard effects emerge from some form of the wealth effect - fiscal contraction reduces the probability for a future increase in taxes, as a result of which the expected lifetime income increases, which raises consumption. Non-Keynesian effects can emerge through a slightly different source, too, as discussed in Giavazzi, Jappelli and Pagano (2000). If the fiscal policy stance is unsustainable, it may lead, if not corrected, to public debt repudiation and severe output losses. Fiscal contraction in such cases reduces the probability of default, which would have affected output adversely. As a result, the expected net lifetime income rises, leading to an increase in current private consumption. Miller, Skidelsky and Weller (1990) propose a model with a similar reasoning - there is a critical level of public debt above which the government imposes a tax on bond holders. As the level of debt increases, the rate on government bonds rises to reflect the increased risk of the tax being imposed. The increased interest rate crowds out private spending. Fiscal contraction then, in a situation when the debt is high, is expected to reduce the debt, hence the probability that the tax will be imposed, hence the interest rate, and increases output.

But, suppose that, in a situation when the debt is high, agents expect that contractionary fiscal policy will increase the debt. Why would this happen? If agents perceive that the multiplier is greater than one, then they would expect that cutting public spending will decrease the GDP more than it will decrease the debt, as a result of which the debt-to-GDP ratio will increase further. The interest rate on government bonds will then rise, to reflect the higher probability of default. In such a situation, the confidence effects may add up to the Keynesian effects, resulting in a greater multiplier when the debt is higher, contrary to the conventional belief. Hence, if agents believe that the multiplier is high, then this may indeed lead to a higher multiplier, when the debt is high. If agents believe that the investment multiplier is higher than the consumption multiplier, and if the consolidation is implemented mainly through cuts in public investment, this explanation is likely to hold only for investment spending, not necessarily for consumption.

The possibility for these self-fulfilling multiple equilibria has recently been discussed by Blanchard, Mauro and Dell'Ariccia (2013), p. 12, and IMF (2013*a*), p. 21. Support for this explanation is found in existing studies on sovereign bonds dynamics, which find that markets value GDP growth more

12. Bertola and Drazen (1993) also develop a model in which the relationship between fiscal policy (government consumption as a share of GDP) and private consumption (as a share of GDP) is non-linear, depending on the level of debt. However, in their model the relationship is negative when the debt is low and positive when the debt is high.

than reduction in fiscal deficit. Romer (2012) finds that bad news about growth is the second most important factor driving increases in the Spanish government bond rate in the period April 2011-April 2012, after news about the response to the European crisis. The analysis in EC (2012*b*), p.35, also points out that financial markets may indeed prefer GDP growth to fiscal adjustment - sovereign spreads are found to react much stronger to expected GDP growth than to changes in fiscal balance. Similar results are found in Caggiano and Greco (2011).

The existing literature (Auerbach and Gorodnichenko (2012*a*), Ilzetzki, Mendoza and Vegh (2010), Kirchner, Cimadomo and Hauptmeier (2010), Nickel and Tudyka (2013), Rusnak (2011)), finds that the fiscal multiplier is lower when the debt is high. Our findings about the higher multiplier in the highly-indebted countries is not necessarily at odds with these studies, because these studies actually exclude the recent consolidation. The shocks in Auerbach and Gorodnichenko (2012*a*) end in 2008 or 2009 (see Figure 3), the data in Ilzetzki, Mendoza and Vegh (2010) end in 2009 (see Tables A1 and A2), the data in Kirchner, Cimadomo and Hauptmeier (2010) end in 2008Q4, while those of Nickel and Tudyka (2013) - in 2010.

Bearing in mind that our results are driven by one country, Greece, it may be worthwhile to consider certain alternative explanations for the association between the government investment and the growth forecast errors. Bi, Qu and Roaf (2012), for instance, argue that the high forecast errors for Greece are due to the overestimated potential output for Greece, not due to the underestimated fiscal multiplier. Their explanation is not in contrast with ours, however. Public investment can affect output both through the potential output and through the output gap. Hence, potential output may have been overestimated exactly because the effects of the cuts in public spending on the potential output have been underestimated.

What are the implications of these findings? If one strongly believes in them, i.e. if the investment multiplier is really that higher than the consumption multiplier, that would suggest that by cutting public consumption and increasing public investment less than proportionately, one can, at the same time, lower the budget deficit and stimulate growth. However, the results may be imprecisely estimated for such a strong interpretation - there are only 62 observations. Also, the multiplier is likely to be different for every country, so, the averages we estimate do not have to hold for every analysed country. The weaker interpretation is, thus, that since the investment multiplier in the indebted countries is likely to be higher than the consumption multiplier, the public investment should come last on the list for cutting, as Alesina and Perotti (1997) argued some time ago. This has not been the practice

during the recent consolidation, as was shown on Figure 1. As can be seen there, public investment was cut in 20 of the 37 countries, while consumption - in only 7.

VI. Conclusion

Fiscal consolidation has dominated discussions among researchers and policy makers, recently. With this paper, we join the discussion, offering some new evidence on the size of the government consumption and investment multipliers, in the highly-indebted and the less-indebted advanced economies. We find evidence that the investment multiplier is likely to be higher than the consumption multiplier, and the multiplier assumed by the policy-makers, in the highly-indebted countries. We put through two possible explanations. First, the highly indebted countries may have at the same time low level of public capital, which would make its marginal product high. Second, in a situation where the highly indebted economies are depressed, with interest rates at the zero lower bound, markets may assume that the fiscal multiplier in them is high. Hence, they may expect that fiscal consolidation will increase the public debt to GDP ratio, instead of decreasing it, because GDP will fall more than the reduction in deficit. This would increase the probability to default and the sovereign bond rates, which may adversely affect output. Consequently, the expectations effects may add up to the Keynesian effects and result in a higher multiplier in the indebted countries. Whatever the explanation, the results have important implications for the design of the consolidation. They suggest that the consolidation should be accompanied by increased public investment.

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VII. Appendix

Table 8: Definitions of the additional variables used in the analysis

Variable	The way it is constructed	Source
Exports	Exports of goods and services in 2011 and 2012, as % of GDP, minus average value for 2007-2010.	WDI
FDI	Foreign direct investment, net inflows, in 2011 and 2012, as % of GDP, minus the average for 2007-2010.	WDI
Portfolio flows	Portfolio Investment, net incurrence of liabilities (excluding exceptional financing) in 2011 and 2012, as % of GDP, minus the average for 2007-2010. The original data is in USD, so it is divided by the nominal GDP.	IFS
Monetary aggregate M1	Monetary aggregate M1 ('money' series in WDI), in 2010 and 2011, as % of GDP, minus the average for 2007-2009 . The original series is in local currency units, so it is divided by the nominal GDP.	WDI
Interest rate	The discount rate of the central bank in 2010 and 2011, minus the average for 2007-2009.	IFS
Capital adequacy	Bank capital to asset ratio in 2010 and 2011.	WDI
Non-performing loans	Bank nonperforming loans to total loans in 2010 and 2011.	WDI
Public debt	General government gross public debt in 2010 and 2011, % of GDP.	WEO April 2013
Budget balance	General government structural balance in 2010 and 2011, % of potential GDP.	WEO April 2013
Current account balance	Current account balance in 2010 and 2011, % of GDP.	WEO April 2013
Coalition government	Dummy if the government in year $t-1$ was a coalition.	DPI 2012
All houses	Dummy if the ruling party had a control over all the parliament houses (name of variable in DPI: ALLHOUSE).	DPI 2012
Left government	Dummy if the ruling party was from the left side of the political spectrum (name of variable in DPI: EXECRLC).	DPI 2012
Share of parliament seats	Share of parliament seats held by the government (name of variable in DPI: MAJ).	DPI 2012

Table 9: Correlation matrix of the variables

	Growth forecast error	Government consumption	Government investment	Exports	FDI	Portfolio flows	Monetary aggregate M1	Interest rate	Non-performing loans	Capital adequacy	Public debt	Budget balance	Current account balance
Growth forecast error	1.00												
Government consumption	-0.13	1.00											
Government investment	0.38	0.17	1.00										
Exports	0.10	-0.05	0.08	1.00									
FDI	-0.09	0.10	0.33	-0.06	1.00								
Portfolio flows	0.16	-0.05	-0.15	-0.02	-0.90	1.00							
Monetary aggregate M1	-0.02	0.13	0.32	0.12	0.81	-0.88	1.00						
Interest rate	-0.21	-0.30	0.21	-0.18	0.04	0.01	0.08	1.00					
Non-performing loans	0.19	-0.26	-0.44	0.34	-0.23	0.13	-0.23	-0.54	1.00				
Capital adequacy	0.28	-0.51	-0.14	0.07	-0.13	0.23	-0.34	-0.14	0.52	1.00			
Public debt	-0.37	0.08	-0.33	-0.06	-0.14	0.09	-0.09	-0.01	0.00	-0.25	1.00		
Budget balance	0.32	0.06	0.33	-0.05	0.23	-0.10	0.19	-0.15	-0.04	0.13	-0.61	1.00	
Current account balance	-0.06	0.32	0.36	0.04	0.31	-0.24	0.46	0.21	-0.41	-0.41	-0.19	0.55	1.00