PAPER

Determinants of the Government Bond Yields of Italy, Spain, Portugal and Greece

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Abstract This article analyzes the trends in the yields of 10-year government securities of the countries of Southern Europe, in particular Greece, Italy Portugal and Spain, over the period 2005-2020. To study the factors affecting the rate of government securities yields of these countries, regression models using the least squares method and vector autoregression framework, namely the Granger test, were constructed. The models investigate the impact of various independent variables, namely government debt, government budget balance, real effective exchange rate and GDP on profitability of the national bonds. It was proved that in the conditions of the ECB's unconventional monetary policy, which continually stimulates demand for government securities, internal factors are no longer the main ones in determining the yields on national bonds and, accordingly, the cost of servicing the public debt of the euro area countries. The consequences of the ECB's monetary policy were most evident in 2020, when unprecedented financial stimulus measures were implemented in the fight against the impact of the COVID-19 pandemic, which led to a drop in government bond yields in Southern Europe to historically low levels. Such a strong dependence of the demand for government bonds and the cost of servicing public debt of Southern European countries on an external factor - the policy of the European Central Bank can lead to serious shocks for national economies in the future, especially when the ECB is forced to abandon the over-expansionary monetary policy.

Keywords: government bond yields, government debt; budget balance; European Central Bank; Southern Europe.

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1. Introduction

Since 2008, the economies of Southern Europe have been in a difficult situation. First, they were negatively affected by the global financial crisis, then they found themselves in the epicenter of the debt crisis in the euro area, and in 2020, like all countries in the world, they faced the COVID-19 pandemic.

In the article the economies of four countries of Southern Europe - Italy, Spain, Portugal and Greece will be analyzed. The problems of the studied countries are evidenced by the fact that over the past 20 years, their economic growth has been lower than in Iraq, Iran, Ukraine, Sudan and many other countries. However, Italy, Spain, Portugal and Greece did achieve some success after a severe sovereign debt crisis: they experienced certain economic growth and made significant bond sales. At the same time, the level of profitability of these bonds is of great importance for the present and future financial and economic stability of the countries, and that is why the paper will identify the main factors influencing it.

2. Literature review

The general issues of servicing the public debt of the different countries of the world including the Southern Europe states and the yield of securities have been widely explored in the literature.

M. Guirguis (2019) analyzed the debt level, gross national savings and dynamics of total investments of Italy, Spain, Portugal and Greece. The results of the analysis show that decrease in total investments, calculated as percent of GDP, together with the current account deficits had strong negative impact on the national economies of Italy, Spain, Portugal and Greece.

M. Cioffi et al. (2019) are considering transferring part of public debt to the European Repayment Fund. In exchange, each country will transfer an annual flow of resources to the Fund. The authors show that such a scheme can be designed so that it does not make any preliminary redistribution between countries, while the euro area, as a whole, would benefit as a decrease in the annual refinancing needs of member countries would improve financial stability. The share of the mutual debt will be fully repaid within a reasonable number of years. This scheme will not endanger the country's commitment to debt reduction; anyway, market discipline will become more efficient on margin.

M. Picarelli et al. (2019) analyze relation between an increase in public debt and reduction of public investments in the countries of euro area. According to the results of the authors` model a 1% increase of public debt of the EU countries leads to a 0.03% reduction of public investments. The authors have also found evidence that the relationship between public debt increase and public investments is strongest in countries with high levels of debt.

P. Della Posta et al. (2020) analyzed the problem of the stability of public debt ratio to GDP in the countries of euro area. From the authors point of view a possible solution

could be in implementation of a market-funded investment program that stimulates growth, which will be especially welcomed because of its positive influence in long-term or even short-term implications for the growth of GDP and for a stabilizing effect on interest rates. Some simulations quantify these effects. C. Andreou et al. (2018) explored the return rate that was earned from investments to the emerging markets and the impact of sovereign credit risk on it. Authors proofed that the sovereign credit ratings changes - upgrades or downgrades had strong effects on the returns received by foreign investors: lower risk leads to lower profitability from investments to the emerging markets.

W. Opie et al. (2019) consider a new method for dynamic hedging of foreign exchange risks in portfolios of international stocks and bonds. The method uses the predictability of the currency yield in time series, which follows the use of the assumed component in the global factor yield. The hedging strategy outperforms the leading alternative approaches to hedging currencies in a large set of sampled performance indicators.

T. Rodionova et al. (2019), I. Lomachynska et al. (2020), S. Yakubovskiy et al. (2020, 2019) identified the main factors influencing the return on assets in the United States, Germany, Japan as well as in the emerging market economies. The results of the study showed that the public debt growth in the United States, Germany and Japan did not have a significant impact on government bond yield. On the other hand, the level of public debt has an impact on government bond yield in the most emerging market economies.

3. Hypothesis, methodology and data

In order to determine the dependence of the yield on 10Y government bonds on the following factors: government debt, balance of government budget, real effective exchange rate, GDP of Greece, Italy, Spain and Portugal, a regression model using the least squares method (LSM) was constructed.

The annual data from 2000 to 2019 was used in this model.

Model with probable dependence is the following:

$$10Y = \alpha + \beta_1 * budget + \beta_2 * govdebt + \beta_3 * ExR + \beta_4 * GDP \tag{1}$$

where *10Y* is the yield on *10Y* government bonds (%), *budget* - balance of government budget (% of GDP), *govdebt* - government debt (% of GDP), *ExR* - real effective exchange rate, *GDP* - gross domestic product.

The second model - Granger test - helps to determine mutual causality between the yield on government bonds and the following factors: government debt, balance of government budget, real effective exchange rate, GDP of Italy, Spain, Portugal and Greece. For this test, annual data from 2000 to 2019 is used.

$$Y10_t = a_1 + \sum_{i=1}^{p} \beta_{1i} V_{t-1} + \sum_{i=1}^{p} Y_{1i} Y_{t-1} + \varepsilon_{1t}$$

$$V_t = a_2 + \sum_{i=1}^{p} \beta_{2i} Y10_{t-1} + \sum_{i=1}^{p} Y_{2i} V_{t-1} + \varepsilon_{2t} \tag{2}$$

Where *Y10* is the yield on government bonds (%), and *V* is the different variables such

as: balance of government budget (% of GDP), government debt (% of GDP), real effective exchange rate, GDP. In this model: ε is error term; α is a constant term; β and Y denote the coefficients to be estimated, p is the lag order selected.

4. Results and discussion

In 2010 the Securities Market Program (SMP) was announced by the European Central Bank (ECB) for Greece. This program consisted of buying national bonds on the secondary market and actually preceded quantitative easing. During the debt crisis the yield on Greek government bonds increased from 5.49% to 12.01%, and already in 2011 reached a maximum value of 21.14% (Fig.1).
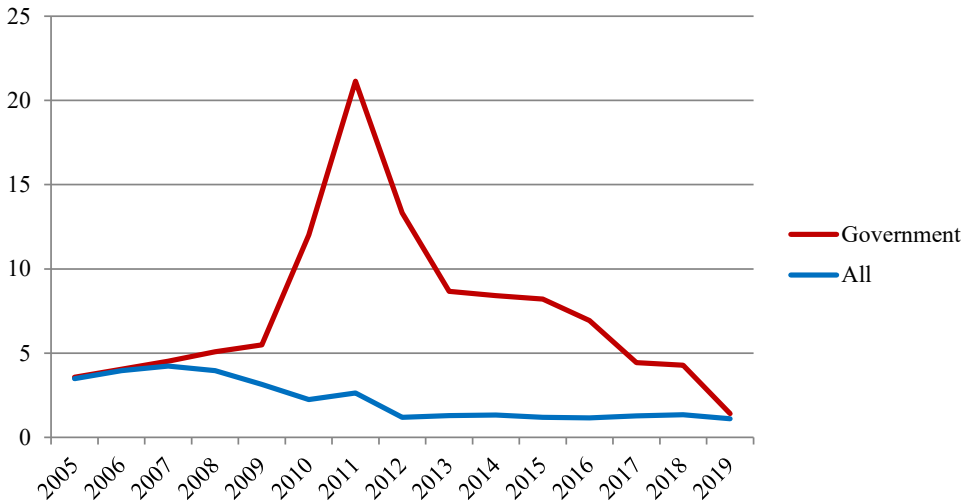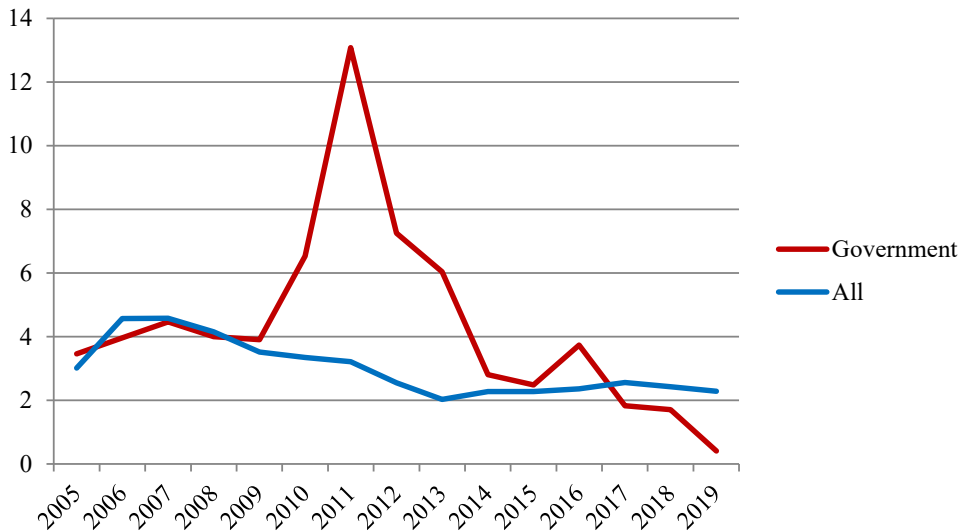

Figure 1. The yield on all types of portfolio investments and government bonds of Greece for the period 2005-2019 (%)
Source: data from ECB (2020).

Since 2012, thanks to interventions in the bond market, yields began to decline. Greece's government bond yields fell below 1% for the first time in 2020 (Trading Economics, 2020), supporting the country's efforts to ease stringent budget conditions imposed by bailout lenders. The yield fell to 0.957%, but remains one of the highest borrowing rates in the eurozone. The constant drop in Greek bond yields is already an indicator of the market's confidence in the course and prospects of the Greek economy, and in the country's economic policy. However, some investors are wary of citing illiquidity. The COVID-19 pandemic has shattered hopes of raising Greece's rating to investment grade in the near future.

As in Greece, in Portugal, in 2011 the yield reached its maximum value and amounted to 13.08%. At the same time, the profitability of all types of investments decreased (Fig. 2).

Figure 2. The yield on all types of portfolio investments and government bonds of Portugal for the period 2005-2019 (%)
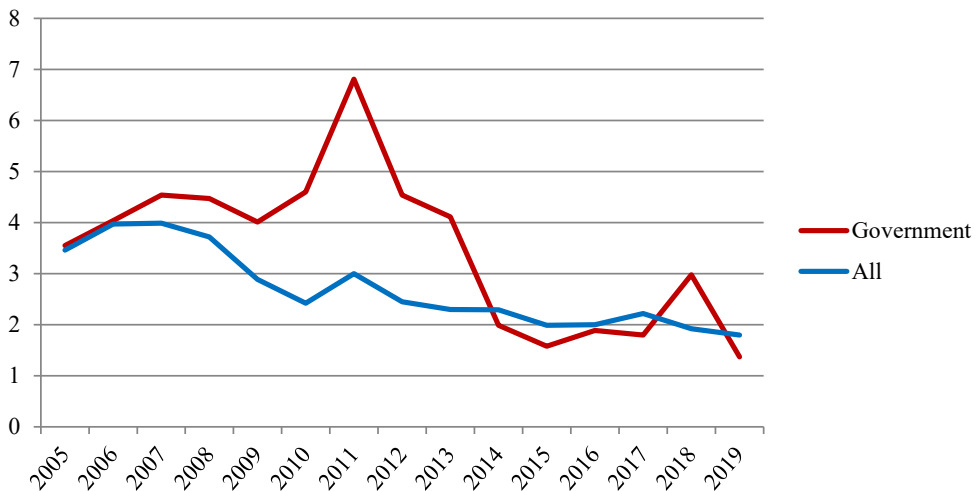Source: data from ECB (2020).

Government bond yields exceeding 13% of course for the eurozone country was super high, but the debt crisis in Portugal was not as acute as in Greece. At the same time, the decline in the yield on Portuguese government bonds to a reasonable level began only after the start of the EU Economic Adjustment Program for Portugal (EAPP). Moreover, after the EAPP realization in 2015 the European Central Bank initiated a program of large-scale purchases of government debt securities of several eurozone member countries (PSPP - Procurement Program in public sector). The total value of acquired state bonds of Portugal at the end of 2015 amounted to 11.2 billion euros. As a result of the implementation of the EU programs to support Portugal's public finances in 2015 the total trading volume of Portuguese national bonds was 2.6 times higher than the total turnover of the previous year. This increase is due to the growing demand for national government debt securities, which in particular reflected an improved investor perception of the Portuguese creditworthiness, as well as a search for yield behavior in the context of low interest rates in alternative savings.

In 2019, the yield on Portuguese government securities reached 0.41% (Fig. 2). Portugal met a quarter of its target of € 15.4 billion in total bond sales for 2019, selling € 4 billion. The country also posted its largest budget surplus since the introduction of the euro. The yield on all investments in the country has increased since 2015. The yield on the country's 10-year bonds rose to 0.97% in April 2020. However, already in July, the figure was 0.4%, the same as in 2019. In Italy, during the debt crisis, the yield on government bonds also increased, but to a lesser extent than in Greece and Portugal, reaching 6.81% in 2011, the yield on all investments in the country also slightly increased compared to the previous year and amounted to 3% (Fig. 3). Unlike Greece

and Portugal, during the period 2015-2017, the yield gradually increased, and already in 2018 it increased to 2.98%. The Italian government's debt sold off, pushing the 10-year bond yields to their highest closing level since 2014. Also following the Italian elections, the fiscal outlook deteriorated and the new government was able to question Italy's continued involvement in the euro area, thus fueling the risk of re-denomination - that is, the risk of being redeemed in a devalued lira instead of a hard euro.

Also, the sharp rise in the yield on government bonds in Italy may be associated with budget problems. One small deficit would also not make a big difference in either government debt or bond yields. However, since public debt is already high, there is no economic growth, which exacerbates the problem. Despite this, in 2019, Italian bond yields fell by about one third to 1.37%. This also happened due to the elections, as investors welcomed a new party that is somewhat less hostile towards the eurozone.

Figure 3. The yield on all types of portfolio investments and government bonds of Italy for the period 2005-2019 (%)
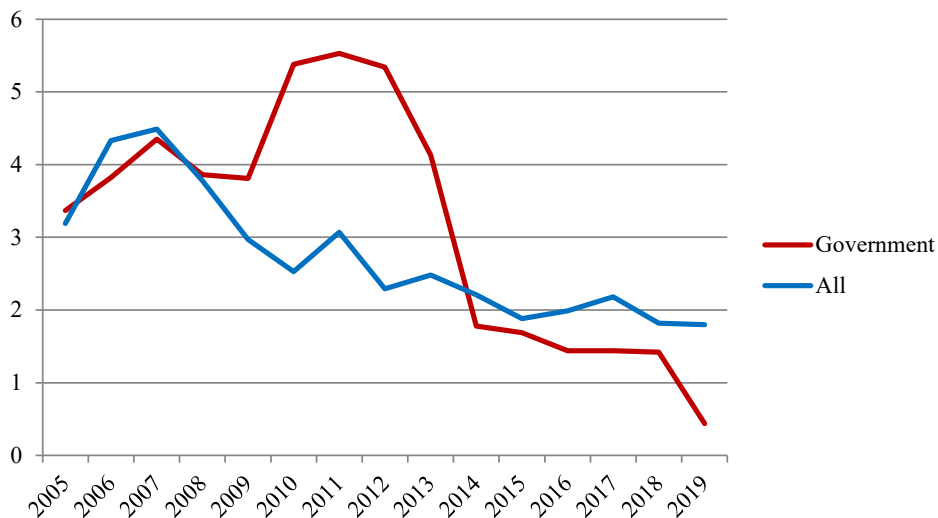Source: data from ECB (2020).

With yields on Italian bonds up to a three-year maturity currently negative, Italy is on the way to regaining its status as a Eurozone issuer. It is worth noting that Greek national bonds have also benefited from the positive climate in European bond markets due to hopes that Italy will get a new government.

In 2020, Italy's government bond yields surged to around 2%, when the country became the first country in Europe to impose isolation. This created fears that the economy of Italy would be hit hard by the virus. In March 2020, amid the pandemic, the ECB launched the €750 billion Pandemic Emergency Purchase Program (PEPP). Moreover, after the PEPP, the European Commission together with the ECB approved a number of measures that led to an inflow of resources to the financial markets of the EU countries, which stimulated an increase in demand for government bonds and, accordingly, a decrease in their yield. Thanks to high yields in the spring, summer

and fall of 2020, Italian bonds remained attractive to investors despite falling GDP. As a result of increased demand, the yield on Italian 10Y bonds declined from 2.35% in March to 1.35% in June and 0.57% in November. In Spain during the debt crisis the yield on government bonds also increased, but to a lesser extent than in Greece, Portugal and Italy. Therefore, in 2011, the yield reached its maximum value for the period under review and amounted to 5.53%. The yield on all investments also increased, but later declined. Every year after 2011 the yield on Spanish government bonds decreased (Fig. 4). This drop in the yields of Spanish bonds, when the indicator was 0.44% in 2019, reflects to some extent the success of the country's economic policy after the peak of the debt crisis in the euro area. Key macroeconomic indicators remain robust in absolute and relative terms, with annual growth rates of Spain and Portugal remaining above 2%, following good progress in reducing the budget deficit, which builds investor confidence in their bonds. In Spain, the yield also increased to 0.82% in April 2020. However, in July, the indicator decreased again and amounted to 0.37%, which was less than in 2019 and in November 2020, bond yields of Spain fell to historic lows of 0.06%.

For all the studied countries, except Greece, in most periods, except for the peak of the debt crisis, the average return on all portfolio investments exceeds the yield on government bonds. This result is explained by the higher reliability of government securities in comparison with other types of portfolio assets. In Greece, due to the high level of public debt and, accordingly, with possible problems with its servicing in the future, the situation is exactly the opposite.

Figure 4. The yield on all types of portfolio investments and government bonds of Spain for the period 2005-2019 (%)
Source: data from ECB (2020).

It should be noted that the measures taken in the midst of the debt crisis by the countries of Southern Europe to curb the growth of public spending have led to unequivocally

positive results in the country's foreign economic activity. Thus, the trade deficit of Greece decreased from 37.5 billion dollars in 2010 to 25.6 billion in 2019; the trade deficit of Portugal decreased from 25.8 billion in 2010 to 18.7 in 2019; the trade deficit of Spain - from 63.5 billion to 29.6. And Italy showed a phenomenal result - its trade deficit in 2010 in the amount of 26.6 billion dollars turned into a surplus of 63.9 billion in 2019. A similar trend is inherent in the current accounts of the studied countries: the current account deficit of Greece decreased from 30.3 billion dollars in 2010 to 3.1 billion in 2019; the current account deficit of Portugal decreased from 24.4 billion in 2010 to 236 million in 2019. The current accounts of Spain and Italy turned from deficit to surplus: the current account deficit of Spain in 2010 in the amount of 52.3 billion dollars turned into a surplus of 29.6 billion in 2019; the current account deficit of Italy in 2010 in the amount of 70.8 billion dollars turned into a surplus of 59.5 billion in 2019.

The results of the LSM that evaluate the hypothesis of the dependence of the yield on 10Y government bonds on the following factors: government debt, balance of government budget, real effective exchange rate, GDP of Greece, Italy, Spain and Portugal are shown in the table 1.

Table 1. Influence of indicators on the yield government bonds of the Southern Europe

	Greece	Italy	Spain	Portugal
Gov. balance	N.S.	N.S.	0.600	0.455
			$(0.001)^a$	$(0.037)^b$
Gov. debt	0.459	-0.514	-0.508	0.433
	$(0.042)^b$	$(0.047)^b$	$(0.004)^a$	$(0.024)^b$
ExR	0.375	N.S.	N.S.	N.S.
	$(0.089)^b$			
GDP	N.S.	N.S.	-0.631	-0.617
			$(0.001)^a$	$(0.032)^b$
R2	0.689	0.899	0.936	0.785
F	5.447^b	11.454^b	14.897^b	6.335^b

Note: N.S. - not significant; a, b, c represent the 1, 5, and 10 % significance levels, respectively. In parentheses, p values are given.
Source: authors` calculations, data from IMF (2020).

Based on the composite models, it can be concluded that the most influential indicator affecting the yield of government bonds of all four countries is government debt, which has a direct relationship for Greece and Portugal: with an increase of government debt by 1 item the yield of government bonds will also increase by 0.459 and 0.453 standard deviations respectively. However, in Italy and Spain there is a reverse and stronger relationship: with an increase of government debt by 1 standard deviation the yield of government bonds of Italy and Spain will decrease by 0.514 and 0.508 standard deviations respectively. The balance of government budget (direct relationship) and

GDP (reverse relationship) impacts only in Spain and Portugal. With an increase in the balance of government budget of Spain and Portugal by 1 standard deviation the yield of government bonds will also increase by 0.600 and 0.455 standard deviations respectively, and with an increase GDP by 1 standard deviation the yield of government bonds will decrease by 0.631 and 0.613 standard deviations respectively. Real effective exchange rate affects the indicator only in Greece and has a direct relationship: with an increase ExR by 1 standard deviation the yield of government bonds will also increase by 0.375 standard deviations.

The results of the Granger test that determine mutual causality between the yield on government bonds and the following factors: government debt, balance of government budget, real effective exchange rate, GDP of Greece, Italy, Spain and Portugal are shown in the table 2.

Table 2. VAR Granger Causality

Country	Indicators	Lagged variables				
		Yield	Gov. balance	Gov. debt	ExR	GDP
Greece	Yield		7.18 (0.007)[a]	8.91 (0.03)[b]	3.52 (0.06)[c]	12.7 (0.002)[a]
	Gov. balance	1.16 (0.28)				
	Gov. debt	4.07 (0.25)				
	ExR	2.24 (0.14)				
	GDP	0.14 (0.93)				
Italy	Yield		1.07 (0.3)	99.6 (0.001)[a]	0.02 (0.88)	14.29 (0.01)[a]
	Gov. balance	0.54 (0.46)				
	Gov. debt	3.95 (0.56)				
	ExR	1.43 (0.23)				
	GDP	28.41 (0.01)[a]				
Spain	Yield		25.2 (0.01)[a]	166.2 (0.01)[a]	43.2 (0.01)[a]	12.45 (0.03)[b]
	Gov. balance	1.98 (0.85)				
	Gov. debt	8.82 (0.12)				
	ExR	1.39 (0.93)				
	GDP	9.9 (0.078)[c]				
Portugal	Yield		44.88 (0.01)[a]	26.12 (0.01)[a]	0.07 (0.79)	6.39 (0.09)[c]
	Gov. balance	0.67 (0.41)				
	Gov. debt	3.64 (0.46)				
	ExR	0.16 (0.69)				
	GDP	10.04 (0.02)[b]				

Note: a, b, c represent the 1, 5, and 10 % significance levels, respectively. In parentheses, p values are given.
Source: authors` calculations, data from IMF (2020).

Based on Table 2, for Greece there is a dependence of the yield on government securities on the balance of the government budget, GDP, government debt and real exchange rate. In Italy, there is a strong mutual relationship between government debt yields and GDP. A dependence of profitability on GDP is observed. In Spain, it is worth noting a strong dependence of profitability on the balance of the state budget, public debt and the real effective exchange rate, the dependence on GDP is less strong, in contrast to other indicators. In Portugal, there is a strong dependence of profitability on public debt and budget balance. The analysis also showed a weak dependence of the country's GDP on the yield on government securities.

5. Conclusion

The results of the analysis show that the countries of Southern Europe, thanks to the adoption of hard budget constraints to combat the causes and consequences of the debt crisis, were able to achieve a substantial increase in the international competitiveness of their national economies, as evidenced by significant improvements in their trade and current account balances.

The results of constructing regression models indicate that the yield of government bonds in Greece and Spain are influenced by the government balance, GDP, government debt and real exchange rate; in Italy – by GDP and government debt and in Portugal – by the government balance, GDP and the level of government debt. In this case, the phenomenon from the point of view of classical economic theory is the fact that in Italy and Spain there is a reverse and stronger relationship between the level of government debt and the yield of government bonds: with an increase of government debt the yield of government bonds of Italy and Spain is decreasing. This simulation result confirms with real facts: over the past 10 years the ratio of government debt to GDP of Italy increased from 119.2% to 134.7%; of Spain – from 60.5% to 95.5%. At the same time, the yield on bonds of all countries of the Southern Europe, including Spain and Italy, fell several times.

This result is explained by the fact that in the conditions of the ECB's unconventional monetary policy, which continually stimulates demand for government securities, internal factors are no longer the main ones in determining the yields on national bonds and, accordingly, the cost of servicing the public debt of the euro area countries. The consequences of the ECB's monetary policy were most evident in 2020, when unprecedented financial stimulus measures were implemented in the fight against the impact of the COVID-19 pandemic, which led to a drop in government bond yields in Southern Europe to historically low levels.

Such a strong dependence of the demand for government bonds and the cost of servicing the public debt of Southern European countries on an external factor - the policy of the European Central Bank can lead to serious shocks for national economies in the future, especially when the ECB is forced to abandon the expansionary monetary policy.

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