



Government debt: the impact of fiscal rules at the European and national level

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Abstract

As Europe and the world surface from the pandemic of 2020–2021, public debt levels have risen substantially, the review of the European Union (EU) economic governance framework is underway and the general escape clause of the stability and growth pact (SGP) is planned to be deactivated at the end of 2023. Against this background, it is important to better understand the dynamics of public debt in the EU. This paper studies how European institutions and sectoral national fiscal rules have affected the formation of public debt. The results suggest that over the last 25 years, the SGP has been an effective tool for lowering government debt levels, at least on average. The establishment of the SGP has been the most effective at lowering government debt, while reforms of the SGP have only had limited effects. The effects of national fiscal rules are heterogenous across different rules and public sector classifications, but it seems that national fiscal rules have at least some effects beyond the SGP in all studied cases. This implies that the EU fiscal framework and EU-level fiscal policies should take into account potential interactions with national fiscal rules and both can be used to increase the effectiveness of fiscal policymaking.

Keywords Stability and growth pact · European fiscal framework · National fiscal rules · National budget · Debt · International fiscal issues

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In memory of Markus Rodlauer

1 Introduction

During the last half-century, the role of the public sector and the conduct of fiscal policy have changed to better match the environment of a global economy. This has led to advanced countries around the world implementing fiscal rules to control the development of government debt, deficit, expenditure and other macroeconomic aspects. Halac and Yared (2018, 2022) note that the number of countries following at least some form of fiscal rules has increased rapidly in the past 30 years.

In the European context, the future of the European Union's (EU) fiscal framework is currently uncertain. The general escape clause (GEC) of the Stability and Growth Pact (SGP) was activated in March 2020 due to the severe economic downturn experienced by the entire EU-area during the pandemic and most member country governments adopted an expansive fiscal policy stance to counter the major economic shock caused by the health situation and lockdowns. While an appropriate reaction to the sudden downturn, it led to substantially increased debt levels. As of writing, the GEC is set to be deactivated at the end of 2023 and the discussion on whether the SGP should be revised to better match the changed economic environment is underway as the review of the EU's economic governance framework has been restarted.¹

Due to this development and the increasing amount of fiscal rules, a growing number of literature discusses different aspects, such as the impact of national fiscal rules on fiscal and macroeconomic aggregates, or the historical performance of EU-wide fiscal rules. Against this background, for the future of European integration as well as in view of the discussion on the potential revisions to the EU fiscal framework, it is important to understand how different EU-level and national-level fiscal rules affect the dynamics and development of public debt. However, the interplay between national and EU fiscal rules appears to be an under-researched area as of yet. This paper aims on filling a part of this gap and, to the best of our knowledge, is the first attempt at studying how a broad range of European institutions, reforms of the European fiscal framework and the introduction of national fiscal rules have affected public debt developments.

The paper uses panel estimations with country and time fixed effects and merges macroeconomic data for the EU Member States with in-depth information on European and national fiscal rules. The findings suggest that the establishment of the EU and the establishment of the SGP have had a lowering effect on government debt. The effectiveness of national fiscal rules is very heterogenous and depends on

¹ On a more theoretical level, some views on the revised fiscal framework have been published. For example, the near-term future has been discussed by Constâncio (2020), who notes that fiscal rules have an important role in combating the 'deficit bias' tendency, but also that the current European fiscal rules are too complex to be efficient, especially as observed in a crisis when monetary policy is already very accommodative. For example, Blanchard et al. (2021) suggest that moving from fiscal rules to fiscal standards could be a potential way forward.

the specific rules and layer of government they address. Most statistically significant classes of national fiscal rules remain significant when the effect of the SGP is included in the regression. In terms of policy implications, the results suggest that the European and national fiscal rules are generally complementary, and both can be used by policymakers for lowering debt levels or restricting the growth of debt. In addition, the EU fiscal framework and EU-level fiscal policies should take into account potential interactions with well-performing national fiscal rules to increase the effectiveness of fiscal policymaking.

The remainder of the paper is organised as follows: Sect. 2 presents some of the concepts used and previous literature concentrating on the research done since the financial crisis, Sect. 3 introduces the approach of the study and Sect. 4 the data used. Section 5 presents the results of the study, and Sect. 6 concludes.

2 Related literature on fiscal rules

The fiscal framework of the EU is quite unique in the World as it sets common fiscal rules for Member States which are in effect alongside any active national fiscal rules. This section provides a short, non-exhaustive summary of recent research studying the effects of fiscal rules which is relevant to the approach and questions presented in this paper.

2.1 The macroeconomic effects of national fiscal rules

There is a vast literature discussing the effects of fiscal rules on fiscal variables. For EU Member States, stronger and more encompassing fiscal rules tend to encourage higher cyclically adjusted primary balances, after taking into account other factors potentially affecting fiscal behaviour (Debrun et al. 2008). This finding has also been confirmed for developing countries (Tapsoba 2012). The adoption of numerical fiscal rules reduces government borrowing costs (Thornton and Vasilakis 2018), and fiscal rules significantly affect the composition of public spending (Vinturis 2023).

The design of fiscal rules appears to be crucial for its disciplining effect (Heinemann et al. 2018; Barbier-Gauchard et al. 2021). Budget balance and expenditure rules seem to have a disciplining effect, while debt rules appear to be less effective (Tapsoba 2012). Specific features of fiscal rules may enhance the disciplining effect (for example independent fiscal bodies, investment-friendly fiscal rules, supranational fiscal rules, or in most cases monitoring outside the government and a “hard” legal basis), while other features (for example fiscal responsibility laws, a higher number of fiscal rules, national fiscal rules, or in most cases a “soft” legal basis, as well as cyclically-adjusted budget balance rules or expenditure ceilings for expenditure rules) may weaken effectiveness (Vinturis 2022). The design of fiscal rules can also critically affect fiscal policy cyclicalities (Combes et al. 2017). Compliance with rules constraining stock (rather than flow) variables, set out in coalitional agreements, and covering larger parts of general government finances appears significantly higher (Reuter 2015). To improve effectiveness, the trade-off between

simplicity, flexibility, and enforceability of fiscal rules could be tackled by downplaying the enforceability part and focusing on fiscal rules consisting of a simple quantitative benchmark for a key fiscal indicator (Debrun and Jonung 2019).

There is also strong evidence that countries with more stringent fiscal rules have a lower output volatility (Badinger and Reuter 2017), and that inflation targeting strengthens fiscal performance, whereas the combination of fiscal rules and inflation targeting tends to be associated with more disciplined macroeconomic policies (Combes et al. 2018). The literature has found a positive effect between fiscal balances and the current account, supporting the twin deficit hypothesis. However, the effect of fiscal balances on the current account depends on the stringency of fiscal (budget balance or debt) rules in place (Badinger et al. 2017).

2.2 The performance of European fiscal rules

The performance of the fiscal rules underlying the Stability and Growth Pact (SGP) has been found to be mixed. Historically, a majority of euro area countries have failed to comply with the rules (Eyraud et al. 2017). The reasons for countries deviating from EU fiscal rules stem from economic need (Hansen 2015), but also from the number of coexisting rules reducing transparency and thus effectiveness (Christofzik et al. 2018). The Excessive Deficit Procedure recommendations (corrective arm of the SGP) have significantly affected both planned and actual fiscal policy, though in a pro-cyclical manner (Thygesen et al. 2019), while the preventive arm of the SGP has had a weak performance in pushing countries to their respective Medium-Term Objectives (De Jong and Gilbert 2019). Against this background, the European Court of Auditors (2018) has found that the combination of the current matrix parameters, allowed deviations and flexibility clauses cumulatively prevented Medium-Term Objectives of EU Member States to be reached within a reasonable period.

3 Methodology

The approach taken in this paper combines elements of previous literature on public debt, institutions and fiscal rules, drawing from papers such as Aizenman et al. (2007), Reinhart and Rogoff (2010), Égert (2015), and Masuch et al. (2017). Several different time windows are studied in order to assess the dynamics comprehensively as well as to get a sense of the persistence of effects on debt: 1-year change for short-term changes, 5-year centered moving average of change for medium-term, and 10-year centered moving average of change for long-term dynamics. The medium- and long-term forms are also expected to eliminate some of the potential short-term noise and business cycle effects from the data. The empirical specification is a panel data estimation with country and time fixed effects, which has the following form:

$$\begin{aligned} \overline{\Delta Debt_{(t\pm x)}^C} = & \alpha + \beta_1 INST_{t-1}^C + \beta_2 Debt_{(t-1)} + \beta_3 \overline{CONT_{(t-1)}^C} \\ & + \beta_4 BankCrisis_{(t-1)} + \beta_5 \overline{\Delta CONT_{(t\pm x)}^C} + \epsilon_t^C \end{aligned} \tag{1}$$

where $\overline{\Delta Debt_{t\pm x}^C}$ is the change of the public debt-to-GDP ratio in country C studied for period t as well as $t \pm x$ for centered moving averages of five-year and ten-year periods. $INST_t^c$ is the variable for the European institution or agreement, $Debt_{(t-1)}$ is the lagged government debt used to control previous debt levels, $CONT_{(t-1)}^C$ the set of lagged control variables consisting of the primary balance, inflation and real interest rates and $\overline{CONT_{(t\pm x)}^C}$ the changes in real GDP and unemployment for periods corresponding to the changes in the dependent variable and $BankCrisis_{(t-1)}$ is a lagged dummy controlling for the effect of banking crises. In addition the effects of investment, trade openness, private consumption, total factor productivity, foreign direct investment, government expenditure, the age dependency ratio, population and debt programmes were studied but were found to be generally insignificant for the sample. The share of stock-flow adjustments (the difference between the change in government debt and the government deficit/surplus for a given period) were also tested, but were found to be insignificant.

In the second part of the study, the approach remains unchanged but the establishment of the SGP and subsequent large-scale reforms replace European institutions.

In the final formulation of the study, the focus is on national fiscal rules and their potential dependence on the SGP and the equation becomes:

$$\begin{aligned} \overline{\Delta Debt_{(t\pm x)}^C} = & \alpha + \beta_1 SGP_{t-1}^C + \beta_2 FiscalRule_{t-1,i}^C + \beta_3 Debt_{(t-1)} \\ & + \beta_4 \overline{CONT_{(t-1)}^C} + \beta_5 \overline{\Delta CONT_{(t\pm x)}^C} + \beta_6 BankCrisis_{(t-1)} + \epsilon_t^C \end{aligned} \tag{2}$$

where everything remains the same as in Eq. 1 except for $FiscalRule_{(t-1,i)}^C$, which is the existence of a fiscal rule of a certain type in country C , government sector i at time $t - 1$ and SGP_{t-1}^C , which is the total effect of the SGP. The effects are studied separately for each type of fiscal rule (budget balance, debt, expenditure and revenue).

The approach taken by the paper is designed to account for the many different facets of EU-level and national fiscal rules as well as potential debt dynamics through different time horizons. The empirical approach of this study is to use country and time fixed effects² and diagonal standard errors and covariance.

4 Data

This section describes the data used in the empirical study. It covers data sources and the sample and describes the data on government debt, European institutions and agreements as well as national fiscal rules. Finally, it discusses the variables

² Results with only country fixed effects or time fixed effects are available upon request.

used in the estimations to control for other factors contributing to the formation of government debt.

The data is compiled from the public databases of the World Bank, the European Central Bank, the International Monetary Fund as well as the European Commission (2023) Fiscal Governance in the EU member states database. The full sample runs from 1990, which is the first observation of the Fiscal Governance database, to 2019 and includes all countries that have been members of the EU at some point of the sample. All sources as well as transformations used are presented in “Appendix 1”.

4.1 Timeline of European institutions and major reforms

The institutions and major reforms of the fiscal rules studied in this paper as well as the years of their introduction are as follows:

1993—The EU is formed.

1997—The Stability and Growth Pact is initiated (Preventive Arm in effect from 1998 and Corrective Arm from 1999).

1999—The Economic and Monetary Union (EMU) is formed and the common currency, the euro, is introduced.

2005—The SGP is amended to better consider individual country circumstances and the economic rationale of the rules is increased.

2011—The ‘Six Pack’ set of rules are added to the SGP to make it more comprehensive and predictable.

2013—The Fiscal Compact is signed by a majority of the Member States and the ‘Two Pack’ set of rules are added to the SGP to increase the importance of budgetary targets and reinforce economic coordination between member countries.

To study the effects of institutions and major reforms the following coding is used:

$$\begin{cases} 0 = \text{a country has not joined the EU or EMU and is not affected by the reform} \\ 1 = \text{a country is a member of EU or EMU and is affected by the reform} \end{cases}$$

Within the studied sample, several countries have joined the EU or adopted the euro later than the initial introduction. They will be considered to be affected by the reform beginning from the year of joining.

4.2 National fiscal rules

National fiscal governance, or the national fiscal framework, is the set of specific rules, procedures, arrangements and institutions for budgetary policy in effect in each of the EU Member States. All EU Member States have adopted some numerical national fiscal rules, which differ in design and the targeted public sector areas.

Table 1 Some examples of national fiscal rules in the fiscal governance database (European Commission 2023) for different sections of the public sector

	Budget balance rules	Debt rules	Expenditure rules	Revenue rules
General government	Targets for the structural balance as % of GDP Adjustment path towards the Medium-Term Objective	Consolidated general government debt at the end of every year may not exceed X% of GDP Growth of the debt-to-GDP ratio must level off during the election period	Ceiling on the size of the general-government sector: % of GDP Setbacks against the expenditure ceilings must be compensated within the sector	Tax-freeze: Direct or indirect tax rates cannot be raised If a multi-year surplus is observed, X% is allocated to repayment of national debt
Central government	The central government deficit should not exceed X% of GDP	The growth of debt-to-GDP ratio must level off during period	Real growth of primary expenditure equal or lower than X%	Any unexpected tax revenues are to be used to reduce the budget deficit
Local government	Voted budgets must be in balance	Local government deficit should not exceed X% of GDP Net indebtedness capped at X% of previous year's revenues	Growth rate of expenditure shall not exceed the average growth rate for the past four years	
Regional government	Total liabilities should not be higher than X times the average of the current net revenue collected in the last X years Transfers from the government to regions to finance the national healthcare system	Indebtedness must be the same at the beginning and at the end of each year End of year liabilities X times the average of the current net revenue collected in the last three years	Expenditure ceilings for specific products The annual growth of expenditure cannot exceed the average medium-term growth rate of GDP	
Social security	Balanced budget rule for the social security sector Social security funds should have a surplus of X of GDP	Budget act to determine the primary balance target	Real growth of health care expenditure ought to be equal or lower than X%	Counter-cyclical regulation of unemployment security contributions and earnings-related pension contributions
Other			Limits on the growth rate of discretionary and new legally mandated expenditure	

Table 2 Descriptive statistics of data used in the study

	Unit	Mean	StdDev	Min	Max
Dependent variable					
Government debt	% of GDP	54.7	34.5	0.8	233.3
Independent variables					
Primary balance	% of potential GDP	- 0.4	3.0	- 12.5	8.8
Inflation	%, y-o-y change	2.5	2.7	- 9.5	32.5
Real interest rate	%	4.0	5.7	- 0.5	58.0
Banking crisis	[0, 1]	0.1	0.3	0.0	1.0
Real GDP	Log	25.9	1.6	22.2	29.0
Unemployment	%	8.7	4.4	0.6	27.5

Table 1 lists examples of different fiscal rules set in various EU countries for different sectors. The following coding is used for national fiscal rules:

$$\begin{cases} 0 = \text{a country does not have any fiscal rules for a specific sector} \\ 1 = \text{a country has set a fiscal rule to a specific sector} \end{cases}$$

4.3 Other data

Table 2 lists the data used in the study as well as descriptive statistics. The banking crisis dummy follows the coding of Laeven and Valencia (2020, p. 309) where a crisis is observed if both of the following conditions are observed: 1. Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations), 2. Significant banking policy intervention measures in response to significant losses in the banking system.

5 Results

This section will study the effects different European institutions, reforms of the SGP and national fiscal rules have on government debt. Of the control variables described in Sects. 3 and 4, real GDP, the primary balance, the real interest rate and inflation are expected to have a negative sign, implying a lowering effect on debt, whereas unemployment and the banking crisis dummy are expected to have a positive sign, implying an increasing effect on debt.

5.1 European institutions and EU-level rules

Table 3 presents the baseline results of the model as well as the effects from EU membership and the adoption of the common currency. The effect of EU

Table 3 Results. Baseline, EU and euro. Dependent variable: change of government debt

Period horizon	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	1y	5y	10y	1y	5y	10y	1y	5y	10y
EU membership(-1)				-0.012** (0.005)	-0.012*** (0.003)	-0.007*** (0.002)			
Euro adoption(-1)							0.002 (0.005)	0.001 (0.002)	-0.001 (0.002)
<i>Controls</i>									
Government debt(-1)	-0.053*** (0.018)	-0.014** (0.007)	0.006 (0.004)	-0.054*** (0.018)	-0.015** (0.006)	0.006 (0.004)	-0.053*** (0.018)	-0.014** (0.007)	0.006 (0.004)
Primary balance(-1)	-0.376*** (0.106)	-0.286*** (0.046)	-0.176*** (0.029)	-0.350*** (0.111)	-0.264*** (0.047)	-0.165*** (0.029)	-0.375*** (0.018)	-0.286*** (0.046)	-0.176*** (0.029)
Inflation(-1)	-0.367*** (0.097)	-0.131*** (0.026)	-0.153*** (0.031)	-0.388*** (0.099)	-0.287*** (0.059)	-0.164*** (0.031)	-0.369*** (0.097)	-0.271*** (0.058)	-0.152*** (0.031)
Interest rate(-1)	-0.160** (0.067)	-0.131*** (0.026)	-0.080*** (0.014)	-0.172** (0.069)	-0.141*** (0.027)	-0.086*** (0.031)	-0.158** (0.066)	-0.130*** (0.026)	-0.081*** (0.014)
Banking crisis(-1)	0.026*** (0.008)	0.014*** (0.003)	0.007*** (0.002)	0.023*** (0.007)	0.012*** (0.003)	0.005*** (0.002)	0.026*** (0.008)	0.014*** (0.003)	0.007*** (0.002)
ΔReal GDP	-0.612*** (0.134)	-0.666*** (0.096)	-0.600*** (0.113)	-0.624*** (0.135)	-0.696*** (0.097)	-0.613*** (0.114)	-0.608*** (0.137)	-0.661*** (0.099)	-0.613*** (0.116)
ΔUnemployment	0.374 (0.251)	0.788*** (0.119)	1.286*** (0.157)	0.353 (0.250)	0.713*** (0.125)	1.177*** (0.158)	0.377 (0.251)	0.793*** (0.119)	1.271*** (0.161)
Constant	0.062*** (0.012)	0.042*** (0.006)	0.026*** (0.005)	0.074*** (0.014)	0.054*** (0.007)	0.033*** (0.005)	0.061*** (0.012)	0.041*** (0.006)	0.027*** (0.005)
Observations	725	727	727	725	727	727	725	727	727
Adj. R ²	0.51	0.73	0.76	0.51	0.74	0.77	0.51	0.73	0.76
F-stat	13.3***	33.9***	39.0***	13.2***	34.7***	39.6***	13.0***	33.3***	38.3***

Fixed effect (country and year) estimates of the relationship of the change of government debt, European Union membership, euro adoption and changes in control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. ***Significant at 1% level, **Significant at 5%, *Significant at 10%

membership is debt lowering and statistically significant, at least at the 5% level for all the studied time windows. The adoption of the euro is insignificant for all studied time horizons.

The control variables act mostly as expected: the lagged primary balance, economic growth and inflation have a lowering effect on the formation of government debt for all time horizons. The same goes for the lagged level of government debt for the 1-year and 5-year windows, implying that the changes are dependent on the initial level of debt at the short-term and medium-term.

Changes in unemployment and the banking crisis dummy have a statistically significant increasing effect on debt for all time horizons with the only exception being the short-term effect of unemployment.

The lagged real interest rate is significant for all time horizons. The negative effect could potentially be attributed to delayed reactions to increasing debt servicing costs or a feature associated with the last third of the studied time period where the financial crisis increased the levels of government debt while central banks eased their monetary stances and rates generally converged towards the zero lower bound.

Table 4 presents the effects of the different phases of the SGP. The establishment of the Pact has had a notable, statistically significant diminishing effect at least on the 5 % level on the formation of government debt in all the studied time horizons³ and the Fiscal Compact and 'Two Pack' set of rules had a statistically significant effect for all time horizons, although only at the 10 % level for the 10-year time window. The SGP amendment and the 'Six Pack' set of rules of 2011 did not have a statistically significant effect on government debt, potentially due to the time of introduction and, based on the results, were not sufficient for controlling the increase of government debt during the financial crisis. The results are largely in line with the results of Baerg and Hallerberg (2016) and Terziev et al. (2018) who also note that the SGP was unable to contain the negative effects of the financial crisis.

To test for robustness, "Appendix 2" presents a comparison of the effects of the establishment of the SGP against other reforms.

5.2 National fiscal rules

Table 5 contains the results for the effects of national budget balance rules for different sectors. Budget balance rules for the general government have a statistically significant lowering effect for the longer time horizons at the 5% level whereas regional government rules have some effect in the long run. Central government rules have a significant increasing effect on government debt in all time horizons, at least at the 10% level.

Many of the budget balance rules for the general government target nominal budget balance or structural balances as % of GDP and these seem the most efficient for lowering debt levels for all time horizons. The results remain largely unchanged in regressions (4) to (6) where the effect of the SGP is included.

³ The impacts of the Preventive Arm rules (1998) and Corrective Arm rules (1999) going into effect were also studied alongside the establishment of the SGP, but the results were almost unchanged and therefore omitted to save space.

Table 4 Results. Different phases of the stability and growth pact. Dependent variable: change of government debt

Period horizon	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1y	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
SGP establishment(-1)	-0.011** (0.005)	-0.012*** (0.003)	-0.010*** (0.002)									
SGP amendment(-1)				-0.004 (0.010)	0.006 (0.004)	0.003 (0.004)						
SGP six pack(-1)							-0.036 (0.026)	-0.002 (0.004)	0.001 (0.003)	-0.031*** (0.010)	-0.018*** (0.004)	-0.005* (0.003)
SGP fiscal compact and two pack(-1)												
<i>Controls</i>												
Government debt(-1)	-0.053*** (0.018)	-0.015** (0.006)	0.005 (0.004)	-0.053*** (0.019)	-0.014** (0.007)	0.007 (0.004)	-0.054*** (0.019)	-0.014** (0.007)	0.006 (0.004)	-0.052*** (0.019)	-0.014** (0.007)	0.007 (0.004)
Primary balance(-1)	-0.353*** (0.109)	-0.262*** (0.047)	-0.157*** (0.029)	-0.376*** (0.106)	-0.287*** (0.046)	-0.176*** (0.029)	-0.374*** (0.106)	-0.286*** (0.046)	-0.176*** (0.029)	-0.376*** (0.106)	-0.286*** (0.046)	-0.176*** (0.029)
Inflation(-1)	-0.378*** (0.098)	-0.277*** (0.058)	-0.159*** (0.030)	-0.368*** (0.097)	-0.268*** (0.058)	-0.152*** (0.031)	-0.367*** (0.097)	-0.270*** (0.058)	-0.153*** (0.031)	-0.367*** (0.097)	-0.270*** (0.058)	-0.153*** (0.031)
Interest rate(-1)	-0.177*** (0.068)	-0.151*** (0.027)	-0.095*** (0.014)	-0.159*** (0.067)	-0.132*** (0.026)	-0.081*** (0.014)	-0.161*** (0.067)	-0.131*** (0.026)	-0.080*** (0.014)	-0.161*** (0.067)	-0.132*** (0.026)	-0.080*** (0.014)
Banking crisis(-1)	0.025*** (0.008)	0.013*** (0.003)	0.006*** (0.002)	0.026*** (0.008)	0.014*** (0.003)	0.007*** (0.002)	0.027*** (0.008)	0.015*** (0.003)	0.007*** (0.002)	0.026*** (0.008)	0.014*** (0.003)	0.007*** (0.002)
ΔReal GDP	-0.626*** (0.134)	-0.720*** (0.097)	-0.660*** (0.111)	-0.612*** (0.134)	-0.666*** (0.097)	-0.601*** (0.114)	-0.614*** (0.134)	-0.666*** (0.097)	-0.600*** (0.114)	-0.614*** (0.134)	-0.667*** (0.097)	-0.600*** (0.113)
ΔUnemployment	0.354 (0.250)	0.718*** (0.122)	1.191*** (0.155)	0.373 (0.251)	0.791*** (0.119)	1.282*** (0.157)	0.363 (0.252)	0.786*** (0.119)	1.286*** (0.157)	0.373 (0.251)	0.790*** (0.119)	1.287*** (0.157)

Table 4 (continued)

Period horizon	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
Constant	0.071*** (0.013)	0.053*** (0.007)	0.036*** (0.005)	0.064*** (0.013)	0.039*** (0.006)	0.024*** (0.005)	0.073*** (0.016)	0.042*** (0.006)	0.026*** (0.005)	0.069*** (0.012)	0.046*** (0.006)	0.027*** (0.005)
Observations	725	727	727	725	727	727	725	727	727	725	727	727
Adj. R ²	0.51	0.74	0.77	0.51	0.73	0.76	0.51	0.73	0.76	0.51	0.73	0.76
F-stat	13.2***	34.4***	40.2***	13.0***	33.4***	38.3***	13.1***	33.3***	38.3***	13.1***	33.4***	38.3***

Fixed effect (country and year) estimates of the relationship of the change of Government Debt, the SGP and its reforms and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. ***Significant at 1% level, **significant at 5%, *significant at 10%

Table 5 National Budget Balance Rules. Dependent variable: Change of Government Debt

Period horizon	(1)	(2)	(3)	(4)	(5)	(6)
	1y	5y	10y	1y	5y	10y
Stability and growth pact(-1)				- 0.012** (0.005)	- 0.013*** (0.003)	- 0.010*** (0.002)
<i>Budget balance rules</i>						
General government(-1)	- 0.003 (0.005)	- 0.006** (0.002)	- 0.004** (0.002)	- 0.004 (0.006)	- 0.006** (0.002)	- 0.004** (0.002)
Central government(-1)	0.016** (0.007)	0.008** (0.003)	0.004* (0.002)	0.016** (0.007)	0.008** (0.003)	0.004* (0.002)
Local government(-1)	- 0.008 (0.007)	- 0.001 (0.004)	0.001 (0.002)	- 0.007 (0.007)	- 0.001 (0.004)	0.002 (0.002)
Regional government(-1)	0.004 (0.007)	- 0.004 (0.003)	- 0.006*** (0.002)	0.004 (0.007)	- 0.003 (0.003)	- 0.005*** (0.002)
Social security(-1)	- 0.008 (0.007)	- 0.002 (0.003)	0.001 (0.002)	- 0.011 (0.007)	- 0.005 (0.003)	- 0.002 (0.002)
<i>Controls</i>						
Government debt(-1)	- 0.059*** (0.021)	- 0.015** (0.007)	0.008* (0.005)	- 0.060*** (0.021)	- 0.017** (0.007)	0.006 (0.005)
Primary balance(-1)	- 0.375*** (0.109)	- 0.275*** (0.045)	- 0.164*** (0.030)	- 0.350*** (0.111)	- 0.249*** (0.046)	- 0.145*** (0.030)
Inflation(-1)	- 0.374*** (0.097)	- 0.268*** (0.058)	- 0.149*** (0.030)	- 0.382*** (0.098)	- 0.273*** (0.058)	- 0.153*** (0.030)
Interest rate(-1)	- 0.163** (0.068)	- 0.132*** (0.027)	- 0.079*** (0.014)	- 0.180*** (0.069)	- 0.151*** (0.027)	- 0.094*** (0.015)
Banking crisis(-1)	0.026*** (0.008)	0.015*** (0.003)	0.007*** (0.002)	0.026*** (0.008)	0.014*** (0.003)	0.007*** (0.002)
ΔReal GDP	- 0.600*** (0.134)	- 0.641*** (0.097)	- 0.571*** (0.114)	- 0.613*** (0.134)	- 0.695*** (0.098)	- 0.634*** (0.111)
ΔUnemployment	0.378 (0.257)	0.832*** (0.121)	1.365*** (0.165)	0.357 (0.256)	0.758*** (0.124)	1.262*** (0.162)
Constant	0.068*** (0.014)	0.043*** (0.007)	0.025*** (0.005)	0.079*** (0.015)	0.056*** (0.007)	0.036*** (0.005)
Observations	725	727	727	725	727	727
Adj. R ²	0.51	0.74	0.76	0.51	0.74	0.77
F-stat	12.3***	31.7***	36.5***	12.3***	32.4***	37.9***

Fixed effect (country and year) estimates of the relationship of the change of Government Debt, national budget balance rules, the SGP and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. ***Significant at 1% level, **significant at 5%, *significant at 10%

Table 6 contains the results for the effects of national debt rules for different sectors. Debt rules for the general government and regional government have a statistically significant lowering effect for the longer time horizons. Interestingly, debt rules on social security are statistically significantly lower government debt levels in the 1-year time horizon, but the effect turns positive for the 10-year time horizon.

Many of the fiscal rules set for the general government specifically target different aspects of the debt-to-GDP ratio, so it is expected that they should directly affect the growth of government debt if complied with. For regional government, the rules consist of different debt ceilings and levels of nominal indebtedness.

When the effect of the SGP is taken into account, the results remain almost unchanged in regressions (4) to (6). This implies that the debt rules set on a national level are complementary to the rules set in the SGP. A notable share of national debt rules match the rules of the SGP, so there are potentially several different channels through which the effects take place.

Table 7 presents the results of expenditure rules for different public sector classes. Expenditure rules for the social security systems and other sectors, mainly restrictions on expenditure growth rates, have a statistically significant effect whereas central government and local government rules have slightly significant increasing effects on debt in longer time horizons. The results remain almost unchanged when the effect of the SGP is included.

Based on the results, expenditure rules for the general government sector, consisting mostly of ceilings or maximum growth rates of nominal or real expenditure, are ineffective at lowering debt levels.

Table 8 presents the results of revenue rules for different public sector classes. Revenue rules for the general government have a statistically significant lowering effect for the longer time horizons whereas rules for central government and the social security system are only significant in individual cases. The effective rules target the allocation of unexpected and surplus revenues or rules on replacing tax reductions with tax increases in other areas.

The results remain unchanged when the SGP is taken into account for revenue rules as well.

Table 6 National debt rules. Dependent variable: change of government debt

Period horizon	(1)	(2)	(3)	(4)	(5)	(6)
	1y	5y	10y	1y	5y	10y
Stability and growth pact(-1)				- 0.011** (0.005)	- 0.012*** (0.003)	- 0.010*** (0.002)
<i>Debt rules</i>						
General government(-1)	- 0.008 (0.006)	- 0.006** (0.003)	- 0.003** (0.002)	- 0.008 (0.006)	- 0.006** (0.002)	- 0.003** (0.002)
Central government(-1)	0.002 (0.007)	- 0.001 (0.003)	- 0.000 (0.002)	0.003 (0.007)	- 0.001 (0.003)	0.000 (0.002)
Local government(-1)	- 0.001 (0.006)	- 0.001 (0.003)	0.001 (0.002)	- 0.001 (0.006)	- 0.001 (0.003)	0.001 (0.002)
Regional government(-1)	- 0.009 (0.010)	- 0.018*** (0.005)	- 0.015*** (0.003)	- 0.010 (0.010)	- 0.018*** (0.004)	- 0.015*** (0.003)
Social security(-1)	- 0.030* (0.018)	- 0.003 (0.008)	0.017*** (0.005)	- 0.028 (0.017)	- 0.001 (0.007)	0.018*** (0.005)
<i>Controls</i>						
Government debt(-1)	- 0.050*** (0.019)	- 0.010 (0.006)	0.010** (0.004)	- 0.050*** (0.019)	- 0.012* (0.006)	0.008* (0.004)
Primary balance(-1)	- 0.367*** (0.108)	- 0.281*** (0.046)	- 0.173*** (0.029)	- 0.344*** (0.110)	- 0.257*** (0.047)	- 0.154*** (0.029)
Inflation(-1)	- 0.379*** (0.099)	- 0.279*** (0.059)	- 0.156*** (0.031)	- 0.389*** (0.100)	- 0.287*** (0.059)	- 0.162*** (0.030)
Interest rate(-1)	- 0.167** (0.071)	- 0.135*** (0.059)	- 0.080*** (0.014)	- 0.184** (0.072)	- 0.155*** (0.028)	- 0.096*** (0.015)
Banking crisis(-1)	0.026*** (0.007)	0.015*** (0.003)	0.007*** (0.002)	0.025*** (0.007)	0.013*** (0.003)	0.006*** (0.002)
ΔReal GDP	- 0.606*** (0.133)	- 0.635*** (0.095)	- 0.562*** (0.113)	- 0.618*** (0.133)	- 0.687*** (0.095)	- 0.621*** (0.111)
ΔUnemployment	0.387 (0.256)	0.843*** (0.120)	1.407*** (0.154)	0.370 (0.256)	0.776*** (0.124)	1.317*** (0.152)
Constant	0.063*** (0.013)	0.041*** (0.006)	0.024*** (0.005)	0.072*** (0.013)	0.053*** (0.007)	0.034*** (0.005)
Observations	725	727	727	725	727	727
Adj. R ²	0.51	0.74	0.77	0.51	0.75	0.78
F-stat	12.4***	32.4***	37.2***	12.3***	32.9***	38.5***

Fixed effect (country and year) estimates of the relationship of the change of Government Debt, national debt rules, the SGP and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. ***Significant at 1% level, **significant at 5%, *significant at 10%

Table 7 National expenditure rules. Dependent variable: change of government debt

Period horizon	(1)	(2)	(3)	(4)	(5)	(6)
	1y	5y	10y	1y	5y	10y
Stability and growth pact(-1)				- 0.014*** (0.005)	- 0.014*** (0.003)	- 0.011*** (0.002)
<i>Expenditure rules</i>						
General government(-1)	- 0.004 (0.005)	- 0.002 (0.002)	- 0.002 (0.002)	- 0.002 (0.005)	- 0.001 (0.002)	- 0.001 (0.002)
Central government(-1)	0.010 (0.007)	0.007* (0.004)	0.004* (0.002)	0.019* (0.007)	0.010** (0.004)	0.006*** (0.002)
Local government(-1)	- 0.003 (0.008)	0.008* (0.005)	0.007* (0.004)	- 0.003 (0.008)	0.008* (0.004)	0.007* (0.004)
Regional government(-1)	- 0.001 (0.009)	- 0.005 (0.005)	- 0.001 (0.004)	- 0.003 (0.009)	- 0.007 (0.005)	- 0.003 (0.004)
Social security(-1)	- 0.019 (0.011)	- 0.012*** (0.004)	- 0.009*** (0.003)	- 0.023* (0.012)	- 0.016*** (0.004)	- 0.013*** (0.003)
Others(-1)	- 0.022 (0.015)	- 0.028*** (0.007)	- 0.009*** (0.003)	- 0.019 (0.015)	- 0.025*** (0.007)	- 0.006* (0.003)
<i>Controls</i>						
Government debt(-1)	- 0.056*** (0.018)	- 0.015** (0.006)	0.005 (0.004)	- 0.056*** (0.018)	- 0.017*** (0.006)	0.004 (0.029)
Primary balance(-1)	- 0.366*** (0.109)	- 0.276*** (0.048)	- 0.164*** (0.029)	- 0.336*** (0.111)	- 0.246*** (0.048)	- 0.142*** (0.029)
Inflation(-1)	- 0.363*** (0.097)	- 0.272*** (0.058)	- 0.154*** (0.030)	- 0.374*** (0.098)	- 0.279*** (0.058)	- 0.161*** (0.014)
Interest rate(-1)	- 0.151** (0.067)	- 0.124*** (0.026)	- 0.076*** (0.014)	- 0.171** (0.068)	- 0.146*** (0.027)	- 0.092*** (0.014)
Banking crisis(-1)	0.027*** (0.008)	0.015*** (0.003)	0.007*** (0.002)	0.027*** (0.008)	0.014*** (0.003)	0.007*** (0.002)
ΔReal GDP	- 0.592*** (0.132)	- 0.618*** (0.092)	- 0.552*** (0.108)	- 0.604*** (0.131)	- 0.671*** (0.092)	- 0.611*** (0.104)
ΔUnemployment	0.390 (0.255)	0.859*** (0.120)	1.361*** (0.158)	0.365 (0.254)	0.781*** (0.124)	1.254*** (0.157)
Constant	0.063*** (0.012)	0.041*** (0.006)	0.025*** (0.005)	0.074*** (0.012)	0.054*** (0.007)	0.036*** (0.005)
Observations	725	727	727	725	727	727
Adj. R ²	0.51	0.74	0.77	0.51	0.75	0.78
F-stat	12.2***	31.6***	36.5***	12.1***	32.5***	38.2***

Fixed effect (country and year) estimates of the relationship of the change of Government Debt, national expenditure rules, the SGP and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. ***Significant at 1% level, **significant at 5%, *significant at 10%

Table 8 National revenue rules. Dependent variable: change of government debt

Period horizon	(1)	(2)	(3)	(4)	(5)	(6)
	1y	5y	10y	1y	5y	10y
Stability and growth pact(-1)				- 0.012** (0.005)	- 0.012*** (0.003)	- 0.009*** (0.002)
<i>Revenue rules</i>						
General government(-1)	0.001 (0.009)	- 0.007* (0.004)	- 0.012*** (0.003)	0.001 (0.009)	- 0.007* (0.004)	- 0.012*** (0.003)
Central government(-1)	0.007 (0.006)	0.001 (0.002)	- 0.004** (0.002)	0.010 (0.006)	0.004 (0.003)	- 0.002 (0.002)
Social security(-1)	0.006 (0.010)	0.008* (0.004)	0.003 (0.003)	0.005 (0.011)	0.006 (0.004)	0.002 (0.003)
<i>Controls</i>						
Government debt(-1)	- 0.053*** (0.019)	- 0.013* (0.007)	0.008* (0.005)	- 0.054*** (0.019)	- 0.015** (0.007)	0.006 (0.005)
Primary balance(-1)	- 0.384*** (0.108)	- 0.287*** (0.047)	- 0.169*** (0.030)	- 0.360*** (0.110)	- 0.263*** (0.048)	- 0.151*** (0.030)
Inflation(-1)	- 0.375*** (0.098)	- 0.274*** (0.058)	- 0.151*** (0.031)	- 0.387*** (0.099)	- 0.282*** (0.059)	- 0.157*** (0.031)
Interest rate(-1)	- 0.162** (0.067)	- 0.132*** (0.026)	- 0.080*** (0.014)	- 0.181*** (0.069)	- 0.152*** (0.027)	- 0.095*** (0.015)
Banking crisis(-1)	0.027*** (0.008)	0.015*** (0.003)	0.007*** (0.002)	0.026*** (0.008)	0.014*** (0.003)	0.006*** (0.002)
ΔReal GDP	- 0.606*** (0.137)	- 0.654*** (0.099)	- 0.602*** (0.116)	- 0.620*** (0.136)	- 0.711*** (0.100)	- 0.663*** (0.114)
ΔUnemployment	0.371 (0.254)	0.803*** (0.121)	1.325*** (0.161)	0.346 (0.253)	0.720*** (0.125)	1.212*** (0.161)
Constant	0.061*** (0.012)	0.041*** (0.006)	0.026*** (0.005)	0.071*** (0.013)	0.053*** (0.007)	0.036*** (0.006)
Observations	725	727	727	725	727	727
Adj. R ²	0.51	0.74	0.76	0.51	0.74	0.77
F-stat	12.6***	32.5***	37.9***	12.6***	33.1***	39.0***

Fixed Effect (country and year) estimates of the relationship of the change of Government Debt, national revenue rules, the SGP and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. ***Significant at 1% level, **significant at 5%, *significant at 10%

6 Conclusions

This paper assesses how different European institutions and national fiscal rules have affected the formation of government debt. It focuses on the establishment and major reforms of the stability and growth pact, the formation of the European Union

and the introduction of the euro as well as different fiscal rules set by governments for different levels of the public sector.

Of the studied major European reforms, the establishment of the European Union and the establishment of the SGP (and the subsequent activations of the preventive arm and the corrective arm) were the most effective at lowering government debt, while the Fiscal Compact and 'Two Pack' set of reforms had some statistically significant effects in shorter time horizons. The SGP amendment and the 'Six Pack' set of rules enacted in 2011 were not effective at restricting the growth of government debt, potentially due to the effects of the global financial crisis and the following European debt crisis.

The effectiveness of national fiscal rules is very heterogeneous and depends on the specific rules and sectors. Budget balance rules have been effective at the general government and regional government levels while central government rules have had an increasing level on debt. Debt rules at the general government and regional government level have had a lowering effect, whereas social security system rules have had a lowering effect in the short run, but an increasing effect on government debt in the long run. Expenditure rules have been effective for the social security system and other sectors whereas central government and local government rules have increased debt. Revenue rules for the general government have had some level of lowering effects on government debt growth.

Based on the results, it seems that fiscal rules used for the general government level are the most efficient for lowering debt levels with the very notable exception of expenditure rules. Specific rules for the social security system and regional government can also be used to reach policy goals, whereas fiscal rules set for the central government or local government appear ineffective or even debt-increasing. However, these results should be interpreted with some caution due to the macro-level approach to fiscal rules taken by this study, and the performance of different forms of sectoral rules can differ significantly between Member States due to country-level differences.

A large majority of the effects from national rules were unchanged when the SGP was accounted for. This implies that while there are similarities between the rules enacted by national governments and European fiscal rules, the two act as complementaries rather than substitutes and the effective use of both can lead to more substantial lowering effects on government debt levels. It also implies that many Member States have beneficial national fiscal rules in effect and, when it comes to fiscal policy, the EU's Fiscal Framework and EU-level fiscal rules should take into account potential interactions with national fiscal rules and both can be used to increase the effectiveness of fiscal policymaking.

The control variables used in this study act mostly as expected and remain stable across the different formulations: the change of economic growth, the primary balance, real interest rates and inflation have a lowering effect on the formation of government debt whereas changes in unemployment and banking crises generally have an increasing effect.

The results of this study suggest that the establishment of the EU as well as the SGP, while heterogeneous between different reforms, have on average had notable lowering effects on government debt. The SGP, in general, has been an effective tool for lowering government debt whether studied individually or together with national fiscal rules.

However, this study takes no stance on the potential effects on economic growth or debt sustainability, which are central topics of European fiscal rules. The effect of national fiscal rules strongly depends on the focus of the rules, but they are largely independent of the SGP.

A more comprehensive look at determinants of government debt and how different dynamics affect the process as well as more detailed reasons, and whether effects are heterogenous for different countries, could be an avenue for future research. Another potential way forward would be a more granular look at how different forms of national fiscal rules for different sectors can affect government debt growth, or by using novel econometric methods to study how the introduction of specific fiscal rules or reforms has affected the development of government debt as done for the formation of the EU and the establishment of the SGP in Kraemer and Lehtimäki (2023). It might also be beneficial to study other indicators of government debt and fiscal status as identified in Bloch and Fall (2016) to better understand different facets of public sector debt sustainability.

Appendix 1: Data description and sources

See Table 9.

Table 9 Variables

Variable	Unit/transformation	Source
EU, EMU and SGP	[0, 1]	European Commission
National fiscal rules	[0, 1]	European Commission
Public sector debt	pct	World Bank
Primary balance	pct	IMF
Real GDP	log	World Bank
Real interest rate	pct	ECB, IMF
Inflation	gdp deflator, pct	World Bank
Unemployment	pct	World Bank
Banking crisis	[0, 1]	IMF (Laeven and Valencia 2020)

Appendix 2: Comparison of SGP establishment with subsequent reforms

See Table 10.

Table 10 Results. Different phases of the stability and growth pact

Period horizon	(1) 1y	(2) 5y	(3) 10y	(4) 1y	(5) 5y	(6) 10y	(7) 1y	(8) 5y	(9) 10y
SGP establishment(-1)	-0.011** (0.005)	-0.014*** (0.003)	-0.011*** (0.002)	-0.010** (0.005)	-0.012*** (0.003)	-0.010*** (0.002)	-0.011** (0.005)	-0.012*** (0.003)	-0.010*** (0.002)
SGP amendment(-1)	0.005 (0.011)	0.016*** (0.005)	0.012*** (0.004)						
SGP six pack(-1)				-0.031 (0.027)	0.003 (0.005)	0.006* (0.003)			
SGP fiscal compact and two pack(-1)							-0.031*** (0.010)	-0.017*** (0.004)	-0.004 (0.003)
<i>Controls</i>									
Government debt(-1)	-0.053*** (0.018)	-0.015** (0.006)	0.005 (0.004)	-0.054*** (0.019)	-0.015** (0.006)	0.005 (0.004)	-0.053*** (0.018)	-0.015** (0.006)	0.005 (0.004)
Primary balance(-1)	-0.353*** (0.109)	-0.259*** (0.047)	-0.156*** (0.029)	-0.353*** (0.109)	-0.262*** (0.047)	-0.158*** (0.029)	-0.354*** (0.109)	-0.262*** (0.047)	-0.157*** (0.029)
Inflation(-1)	-0.377*** (0.098)	-0.275*** (0.058)	-0.157*** (0.030)	-0.377*** (0.098)	-0.277*** (0.058)	-0.159*** (0.031)	-0.377*** (0.098)	-0.277*** (0.058)	-0.159*** (0.031)
Interest rate(-1)	-0.179** (0.069)	-0.158*** (0.027)	-0.100*** (0.015)	-0.177*** (0.068)	-0.151*** (0.027)	-0.095*** (0.014)	-0.178*** (0.069)	-0.152*** (0.027)	-0.095*** (0.014)
Banking crisis(-1)	0.025*** (0.008)	0.013*** (0.003)	0.006*** (0.002)	0.026*** (0.008)	0.013*** (0.003)	0.006*** (0.002)	0.025*** (0.008)	0.013*** (0.003)	0.006*** (0.002)

Table 10 (continued)

Period horizon	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	1y	5y	10y	1y	5y	10y	1y	5y	10y
Δ Real GDP	-0.626*** (0.134)	-0.729*** (0.097)	-0.679*** (0.112)	-0.626*** (0.134)	-0.720*** (0.098)	-0.663*** (0.112)	-0.627*** (0.134)	-0.720*** (0.097)	-0.660*** (0.111)
Δ Unemployment	0.355 (0.250)	0.712*** (0.121)	1.157*** (0.156)	0.346 (0.251)	0.720*** (0.123)	1.188*** (0.156)	0.354 (0.250)	0.720*** (0.122)	1.191*** (0.155)
Constant	0.069*** (0.013)	0.047*** (0.007)	0.031*** (0.005)	0.081*** (0.016)	0.052*** (0.007)	0.034*** (0.005)	0.078*** (0.013)	0.057*** (0.007)	0.037*** (0.005)
Observations	725	727	727	725	727	727	725	727	727
Adj. R ²	0.51	0.74	0.77	0.51	0.74	0.77	0.51	0.74	0.77
F-stat	12.9***	34.2***	40.1***	13.0***	33.4***	39.5***	12.9***	33.9***	39.5***

Fixed effect (country and year) estimates of the relationship of the change of Government Debt (dependent variable), European Union membership, euro adoption and changes in control variables. 1y = 1-year change, centered moving average, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%

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