The Market and the People: influence of debt ratings and elections on European fiscal stances (1991-2019)*

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Abstract

This paper proposes an analysis of the fiscal stance by exploring the fiscal policy makers point of view. With a sample covering the period 1991-2019 and including 19 European countries, we estimate fiscal reaction functions (FRF) with novel variables such as market indicators, the type of government or the shadow short rate. Our FRF also allows different response lapses and non-linearity. We provide evidence that the market incentives, through debt rating, play a significant role in maintaining sound fiscal policies. The results also indicate the presence of a political cycle in Europe, with a worsening of the primary balance deficit before elections. Finally, the monetary policy substantially impacts the fiscal possibilities of countries by giving them more flexibility and lowering cost of deficits.

1. Introduction

The Covid-19 pandemic and its subsequent economic consequences have put a strain on public finances of European countries. In response to the unprecedented scale and the asymmetric effects of the Covid-19 crisis, EU policymakers have deployed a broad set of measures at country-level, that have resulted overall in a drastic increase in the public debt.[1] These emergency policies have led to a situation that threaten the fiscal sustainability of European countries, some of which were already in dire straits.

The question of fiscal sustainability is particularly important in Europe, in light of the economic European integration and the financial and economic precedents. But the crisis has also highlighted the obsolescence of the European fiscal rules and their inadequacy with the actual macroeconomic

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[1]In the Euro Area, the government deficit to GDP ratio dramatically increased to a historic high, going from 0.6% in 2019 to 7.2% in 2020 (Eurostat).

conditions. New proposals have been put forward for an alternative European fiscal framework such as the adoption of fiscal standards rather than fiscal rules (Blanchard et al. (2021)), a European central fiscal capacity (European Fiscal Board (2020)), or country-specific fiscal targets rather than uniform numerical criteria (Martin et al. (2021)). These recommendations focus on the framework in which the fiscal policy is possible, defining the boundaries that are not to be overstepped, and constitute a substantial aspect for sustainable public finances. However, they are not sufficient to ensure sound fiscal behaviours, as reflect for example the track records of compliance with the fiscal rules (Larch and Santacroce (2020)). Discretionary fiscal policies adopted these last decades have been associated to significant increases of the debt level in European countries. Their ability to stabilize the economy and to cope with fluctuations of the business cycle, which is a key role of fiscal policies, seems consequently to be limited. Along with these researches aforementioned, a closer look at the fiscal behaviour itself is then necessary to improve the fiscal discipline of EU countries. Our paper is in line with this approach and expands on the existing literature by investigating the variables at play in the fiscal policy-making process.

In that way, Bohn (1998) proposes an attractive and interesting approach to study fiscal behaviours: he defines a *fiscal reaction function* (henceforth, FRF) linking, the primary balance[2] and the outstanding debt of a country. The FRF constitutes a good test for the fiscal solvency as well: a positive and significant coefficient connecting the primary balance and the debt-to-GDP ratio is a sufficient, but weak (Ghosh et al. (2013)), condition to conclude to a sustainable debt. The FRF has been since widely used to study the fiscal policies adopted and their sustainability, and several factors and forms have been adopted to make it more realistic.

Part of these new factors are motivated by political considerations. Indeed, policymakers face conflicting pressures between ensuring reelection, satisfying group interests and leading economically sound and socially fair policies. Talvi and Végh (2005) have developed a model of optimal fiscal policy to understand procyclicality of fiscal policies incorporating the possibility of a "political distortion". While economic booms should be an opportunity for fiscal authorities to build up surpluses, they tend to lower the tax and/or increase the spending due to that political aspect. This conclusion is supported empirically by Larch et al. (2019), who interpret this result as an aversion to unpopular tax increases and/or expenditures cuts. The institutional setting or the number of power

[2]Thereafter, numerous studies have privileged the cyclically adjusted primary balance as the dependent variable. Checherita-Westphal and Žďárek (2017a) discuss the difference between the primary balance and its cyclically adjusted version.

blocs in competition for funds can also impact the fiscal policies (Lane (2003)), as well as particular phenomenon proper to the policymaker. For example, Alesina and Tabellini (2005) and Sugata and Neanidis (2017) deal with the impact of corruption on fiscal policy orientations. Specifically, the former establish a link between corruption and procyclicality of the fiscal policy - the higher the level of corruption, the higher the procyclicality - while Sugata and Neanidis (2017) conclude to a dissociation between public spending and expenditures when corruption occurs, with higher tax and lower spending. Eventually, political influences can also be time-varying, and take the form of a cycle, as theorized in the Political budget cycle theory (Nordhaus (1975)). The presence of a political budget cycle has been repeatedly noticed, notably through a negative impact of election years on the primary balance (Checherita-Westphal and Žďárek (2017a); Larch et al. (2021)). We include in our model election dates, but contrary to previous works, vary the time distance to study the variations of the primary balance *ante* and *post* election years. We also include in our model a dummy variable for the type of government, differentiating between single-party majority government and coalition, in the vein of Lane (2003). Since coalition governments are the product of negotiations between different political forces, we expect a more neutral fiscal policies in countries lead by coalition governments.

The link between fiscal behaviour and financial markets has been explored too. Financial markets are particularly sensible to the fiscal sustainability of governments since sovereign debts are financed in the bond markets by sovereign and private investors. Based on a large set of variables going from macroeconomic to market-based indicators, the sovereign debt pricing indicates a "market's sentiment" (Dufrénot et al. (2016)) that policymakers include in their policy-making process. Indeed, the financing conditions - and specifically the level of interest payments - impact the fiscal situation and sustainability of countries (Fincke and Greiner (2012); Checherita-Westphal and Domingues Semeano (2020)). Maltritz and Wüste (2015) and Barbier-Gauchard and Mazuy (2018), using both fiscal reaction function, adopt the ten-year government bonds as a proxy for the above-mentioned "markets' sentiment" and find no evidence of financial market pressure. Legrenzi and Milas (2013) reach the same conclusion using the spread between the 10-year yield on a set of European countries and the 10-year yield on German bonds, but find significant effect when considering a composite indicator of financial pressure. Tamborini and Tomaselli (2020) are closer to our approach since they adopt ratings of sovereign bonds by Standard and Poor's as a proxy of market pressure (among others) to study measures of austerity in the European Union. We believe that adopting index such as credit ratings constitutes a good alternative to the credit spreads or interest rates for two reasons:

(i) the credit rating and the policy-making process have closer (low) frequencies than the latter and interest spread (high frequency) one, and (ii) the publicity - ultimately the impact - of credit ratings is more important in mainstream medias than the one of interest variations and credit spreads. Being sensible to public opinion and big signals from markets, policymakers may be more keen to incorporate credit ratings variation in their policy-making process. We innovate by including in our FRF the annual average of foreign currency long-term sovereign debt ratings by Moody's, Standard & Poor's, and Fitch Ratings (Kose et al. (2017)).

At last, a crucial aspect of the FRF is the functional form adopted, especially the relationship between the fiscal policy variable and the debt. The seminal paper by Ghosh et al. (2013) introduces the *non-linear* fiscal reaction function to take into account the empirical observed cubic relationship between the primary balance and the lagged debt ratios, reflecting a "fiscal fatigue"; a phenomenon that Checherita-Westphal and Žďárek (2017a) do not observe when adopting the strategy of Ghosh et al. (2013) for Euro area countries. Mendoza and Ostry (2008) and Theofilakou and Stournaras (2012) fail to find any non-linearity under the form of a cubic relationship, but find evidence of a threshold effect of debt on public spendings. Legrenzi and Milas (2013) share this conclusion when allowing the threshold to vary in response to economic conditions. The evidence of a non-linearity of the FRF is, nevertheless, being dashed once we correct our estimation of the panel structure and allow country-specific coefficients (Everaert and Pozzi (2007)). Larch et al. (2021) adopt also a non-linear approach by incorporating interaction terms in the FRF. They create a dummy variable that interact with the change business cycle variable and test several possible factors. While the change in the sign of the output gap significantly impacts the fiscal policy, the level of debt does not influence the relationship between the business cycle and the primary balance. Building on their approach, we adopt a non-linear FRF by incorporating an interaction term to study the impact of the level of the debt-to-GDP ratio on the relationship between the change in primary balance and the change in the output gap.

The rest of the paper is organized as follows: Section 2 presents the data and the method employed to estimate our model. Section 3 displays the results we obtain. Finally, Section 4 concludes.

2. Data and Methodology

2.1. Data

Our panel is composed of 19 European countries, namely Austria, Belgium, Cyprus, Germany, Spain, Estonia, Finland, France, Greece, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta,

Netherlands, Portugal, Slovakia and Slovenia, over the period 1991-2019 (29 years). We end up with 551 country-time observations (annual frequency) and a strongly balanced panel. All of the above-mentioned countries are members of the euro area. The main data source is the World Bank Cross-Country Database of Fiscal Space (Kose et al. (2017)). Data on election date and the type of government derive from the Comparative Political Data Set (Armingeon et al. (2020)), and GDP time series come from the World Bank Database. Finally, data on the Shadow Short Rate come from the Leo Krippner website. Table 1 presents a detailed description of the variables.

General government gross debt, current account balance of payments and GDP cyclical component are classical components of fiscal reaction functions. The general government gross debt represents the budget constraint policymakers face when defining fiscal policies, the current account balance of payments aims at incorporating possible cross-country spillovers, and the GDP cyclical components the cyclical conditions. In line with a large strand of the literature, we included political economy variables as election dates (in the form of a dummy variable), and a market perception of the fiscal policy with the foreign currency long-term sovereign debt ratings.

We also conducted tests for unit roots developed by Im et al. (2003) and Choi (2001), adapted to our type of panel structure.[3] Statistics and *p-values* obtained are presented in Table 2. Results concerning variables such as the business cycle (Hodrick-Prescott (HP) and Christiano-Fitzgerald (CF) filters), the primary balance, the cyclically-adjusted balance and the fiscal balance converge to the absence of unit roots, and consequently these variables are usable in level.[4] We are in a grey zone for two variables, that is the foreign currency long-term sovereign debt ratings and the General government gross debt: the Im-Pesaran-Shin test allows us to reject the null that all series contain a unit root, while we cannot reach this conclusion with the Fisher-type test. Lastly, we are unable to reject the null hypothesis for current account balance of payments and the shadow short rate. Table 3 presents the results of the same tests applied to the variables in difference. None of the series seems to be characterised by the presence a unit-root (our variables are then $I(1)$). Unfortunately, results for the 5-year sovereign CDS spreads and the shadow short rate are not presented because the number of time periods is insufficient to compute the statistics. These results encourage us to adopt a model in difference, to avoid any problems related to non-stationarity.

[3] Both tests are based on a heterogeneous specification of the alternative hypothesis, to be considered here since we have a heterogeneous panel of countries.

[4] The null hypothesis for both tests is that all the panels contain a unit root.

Table 1: Descriptive statistics

Variable		*Mean*	*Std. Dev.*	*Min*	*Max*	*Observations*
Foreign currency long-term sovereign debt ratings, index from 1-21	overall	17.48403	3.658737	2.842441	21	$N = 520$
	between		3.010183	11.49811	21	$n = 19$
	within		2.17317	8.020574	22.93036	$\overline{T} = 27.3684$
5-year sovereign CDS spreads, basis points	overall	347.0739	3253.789	2	50990.61	$N = 246$
	between		750.2741	22.91661	3181.932	$n = 17$
	within		3147.108	-2826.858	48155.76	$\overline{T} = 14.4706$
Fiscal balance, % of average tax revenues	overall	-11.75153	15.75715	-130.5527	21.55893	$N = 518$
	between		8.731489	-29.63211	7.098908	$n = 19$
	within		13.19512	-131.0886	22.69317	$\overline{T} = 27.2632$
Primary balance, % of GDP	overall	-.2737852	3.23735	-29.812	7.616	$N = 517$
	between		1.319529	-2.99788	2.395172	$n = 19$
	within		2.97127	-30.08614	7.565077	$\overline{T} = 27.2105$
Cyclically-adjusted balance, % of potential GDP	overall	-2.700526	3.393461	-27.48857	5.448505	$N = 511$
	between		1.988638	-6.34828	2.086433	$n = 19$
	within		2.787387	-27.82035	5.661124	$\overline{T} = 26.8947$
General government gross debt, % of GDP	overall	63.10071	36.79731	3.766	189.886	$N = 519$
	between		32.83244	6.93004	127.9493	$n = 19$
	within		18.34719	10.46943	125.0374	$\overline{T} = 27.3158$
Gross Domestic Product (GDP)	overall	6.32e+11	9.44e+11	4.51e+09	3.94e+12	$N = 540$
	between		9.53e+11	8.32e+09	3.27e+12	$n = 19$
	within		1.35e+11	6.54e+10	1.30e+12	$\overline{T} = 28.4211$
Current account balance of payments, % of GDP	overall	-.3849814	5.589949	-20.84025	12.58237	$N = 370$
	between		4.231222	-6.637716	8.187112	$n = 17$
	within		3.883695	-16.21171	12.81545	$\overline{T} = 21.7647$
GDP cyclical component (HP filter)	overall	.1443274	131.5148	-1353.307	846.6428	$N = 540$
	between		4.848777	-4.800328	18.97102	$n = 19$
	within		131.4282	-1372.133	827.8161	$\overline{T} = 28.4211$
GDP cyclical component (CF filter)	overall	.6929892	118.6272	-1372.947	736.8346	$N = 540$
	between		1.586334	-.7553701	6.902918	$n = 19$
	within		118.6169	-1379.157	730.6247	$\overline{T} = 28.4211$
Shadow Short Rate (SSR)	overall	1.2252	2.369624	-3.01	4.39	$N = 475$
	between		0	1.2252	1.2252	$n = 19$
	within		2.369624	-3.01	4.39	$T = 25$

Note : "overall" corresponds to the whole sample without taking into account the panel structure, "between" is the statistics at the country-level, "within" can be seen as the average statistics at the panel-level. N refers to the total number of observations, n the number of observations at the panel-level and $\overline{T}$ the number of observations at the country-level.

Table 2: Unit-root tests results (level)

Variables	*Im-Pesaran-Shin*		*Fisher-type*	
	Statistic	*p-value*	Statistic	*p-value*
Foreign currency long-term sovereign debt ratings	-1.6456	0.0499	0.5612	0.7127
General government gross debt	-2.3475	0.0094	-0.6220	0.2670
Business cycles (HP filter)	-18.3564	0.0000	-13.4946	0.0000
Business cycles (CF filter)	-22.4088	0.0000	-23.8239	0.0000
Primary balance	-4.3317	0.000	-5.0544	0.0000
Cyclically-adjusted balance	-5.5327	0.0000	-7.1862	0.0000
Current account balance of payments	-0.5955	0.2758	-0.2256	0.4108
Fiscal balance	-4.1164	0.0000	-5.7333	0.0000
Shadow Short Rate (SSR)	3.6076	0.9998	4.8830	1.0000

Note : The statistic of the Im-Pesaran-Shin test is the W_{t-bar} statistic, while the one used in the Fisher-type test is the inverse normal Z statistic, recommended in application (Choi (2001)). The 5-year sovereign CDS spreads is not included in the table since the number of time periods to compute the statistics is insufficient.

Table 3: Unit-root tests results (difference)

Variables	*Im-Pesaran-Shin*		*Fisher-type*	
	Statistic	*p-value*	Statistic	*p-value*
ΔForeign currency long-term sovereign debt ratings	-7.4778	0.0000	-6.7924	0.0000
ΔGeneral government gross debt	-9.4255	0.0000	-11.8310	0.0000
ΔBusiness cycles (HP filter)	-19.7276	0.0000	-22.5829	0.0000
ΔBusiness cycles (CF filter)	-18.5895	0.0000	-31.0836	0.0000
ΔPrimary balance	-17.3537	0.000	-23.6618	0.0000
ΔCyclically-adjusted balance	-16.9740	0.0000	-22.7662	0.0000
ΔCurrent account balance of payments	-12.4470	0.0000	-11.6871	0.0000
ΔFiscal balance	-18.1777	0.0000	-22.0158	0.0000

Note : The statistic of the Im-Pesaran-Shin test is the W_{t-bar} statistic, while the one used in the Fisher-type test is the inverse normal Z statistic, recommended in application (Choi (2001)). The 5-year sovereign CDS spreads and the shadow short rate are not included in the table since the number of time periods to compute the statistics is insufficient.

2.2. Methodology

Building on the approach of Bohn (1998) and Ghosh et al. (2013), the main FRF adopts the following form :

$$\text{pb}_{i,t} = \alpha + \beta_1 \text{pb}_{i,t-1} + \beta_2 \text{debt}_{i,t} + \beta_3 \text{debt}_{i,t}^2 + \beta_4 \text{debt}_{i,t}^3 + \sum_{c=1}^{n} \beta_c X_{c,i,t} + \delta_i + \epsilon_{i,t} \quad (1)$$

with $\text{pb}_{i,t}$ the primary balance of the country i at time t, $\text{pb}_{i,t-1}$ its lagged value, $\text{debt}_{i,t}$ is the debt-to-GDP ratio of the country i at time t, $\text{debt}_{i,t}^2$ and $\text{debt}_{i,t}^3$ the square and cubic values of the latter, $X_{c,i,t}$ is a set a n control variables for every country i at time t, δ_i a country fixed effect and $\epsilon_{i,t}$ the error term.

A large variety of FRF specifications has been explored in the literature, regarding its *dynamic* nature or the *linearity* of the relationship with the debt-to-GDP ratio.[5] However, few have focused on the lead-lag structure, usually considering the $t-1$ values of the explaining variables. This approach is understandable since (i) the fiscal policy is defined and implemented following a legislative process that does not allow a quick adjustment, and (ii) because the set of available information necessary for the decision-making is incomplete at time t.[6] The policy-maker relies then on the information available at $t-1$ to establish the fiscal policy at t. We believe that a more subtle approach is to take into account lagged variables $(t-1)$ such as the debt-to-GDP ratio, but also lead variables $(t+1)$, as election dates are predictable and influence upstream economic policies (Alesina and Passalacqua (2016)), and variables in t that fiscal authority can be notified of when happening, such as sovereign debt ratings. Our FRF is then designed to taking into account the forward-, backward- and contemporary-looking ability of the policymaker. Accordingly, our specification takes the following form :

$$\Delta\text{pb}_{i,t} = \alpha + \beta_1 \Delta\text{pb}_{i,t-1} + \sum_{a=2}^{l} \beta_a W_{(a,i,t+1)} + \sum_{b=l+1}^{m} \beta_b X_{(b,i,t)} + \sum_{c=m+1}^{n} \beta_c Y_{(c,i,t-1)} + \delta_i + \epsilon_{i,t} \quad (2)$$

with $W_{(a,i,t+1)}$, $X_{(b,i,t)}$ and $Y_{(c,i,t-1)}$ different sets of variables at $t+1$, t and $t-1$, respectively. We also take into account the persistence in the primary balance series by incorporating the lagged values of the dependent variable $(\Delta\text{pb}_{i,t-1})$. The next step consists into defining the variables that make up each set. Our first configuration is as follow: $W_{(a,i,t+1)} = (\text{election date}_{(i,t+1)})$, $X_{(b,i,t)} =$

[5] A more comprehensive presentation of the specification issues is made by Everaert and Jansen (2018).

[6] To circumvent this problem, Larch and Santacroce (2020) explore alternative measurements of the cyclical component such as the change in the unemployment rate, industrial production index and OECD composite leading indicator.

(Δsovereign rate$_{(i,t)}$) and $Y_{(b,i,t)}$ = (ΔGeneral government gross debt$_{(i,t)}$, ΔBusiness cycles$_{(i,t-1)}$, ΔPrimary balance$_{(i,t-1)}$, ΔCyclically $-$ adjusted balance$_{(i,t-1)}$, ΔCurrent account balance of payments$_{(i,t-1)}$, ΔFiscal balance$_{(i,t-1)}$). We vary the composition of the sets of variables to control for longer, or not, forward- and contemporary-looking effects.

Our approach consists in a *non linear* FRF, since we include in our model an interaction term for the reaction of the primary balance to the debt ratio. By that, we aim at taking into account the possibility of a fiscal fatigue (Ghosh et al. (2013)), i.e., the possible exhaustion of the fiscal capacities of a country after reaching a certain amount of debt. Our approach is then similar to the one adopted by Larch et al. (2021), who also include an interaction term. But we differ by interacting two different variables between them, and not a factor with an existing variable. Our interaction variable is defined as follow: $FF_{i,t-1} = \Delta\text{ouput}_{i,t-1}.\text{debt}_{i,t}$. We justify this variable by the importance of the debt-level effect in the reaction of the primary balance to the business cycles: a country can adopt a counter-cyclical fiscal policy when fiscal space is still available, roughly when the debt level is moderate. However, countries have no room when the debt level is very high. The marginal effect is then:

$$\frac{\partial \Delta \text{PB}_{i,t}}{\partial \Delta \text{output}_{i,t}} = \beta_{c_1} + \beta_{c_2}\text{debt}_{i,t-1} \tag{3}$$

with $\text{PB}_{i,t}$ the primary balance of country i at time t, β_{c_1} the coefficient associated to the change in output and β_{c_2} the coefficient associated to the interaction variable. We expect β_{c_2} to be negative and $\beta_{c_2}\text{debt}_{i,t-1}$ to overcome the effect of β_{c_1} at a certain level of $\text{debt}_{i,t-1}$.

On the endogeneity issue

We may face several estimation issues by choosing the theoretical model (2). Indeed, two sources of endogeneity are identifiable: (i) one relates to the dynamic nature of our model, and (ii) one to its simultaneous nature. Regarding the former, Checherita-Westphal and Žďárek (2017b) remind that the Nickell's biais is negligible for panels with a time dimension greater than 20, even though Judson and Owen (1999) pointed out that "even with a time dimension T as large as 30, we find that the bias may be equal to as much 20% of the true value of the coefficient of interest". To meet this risk, we estimate our model with the bias-corrected least-square dummy variable (LSDVC) developped by Bruno (2005) and which is usually used in the literature. Performance of the LSDVC can be limited by the time dimension of our panel, we then also use the bootstrap-corrected fixed-effects estimator for dynamic panel-data models (BCFE) by Everaert and Jansen (2018) which is appropriate for medium size panels. The GMM estimator is often used in case of dynamic model, rightly or wrongly, but might present poor performances and mixed results when the cross-section

dimension is rather small, which is our case here. Since the Nickell's bias may be negligible thanks to the time dimension of our dataset, we also estimate our model with the fixed effect (FE) estimator.

The simultaneity of our model is the second challenge we face. Several of our explanatory variables, such as the cyclical component, the current account balance of payments and the level of debt, are impacted by our dependent variables, i.e. the primary balance. To tackle this problem, much of the literature has employed instrumental variables techniques, principally two-stage least square methods, which required the selection of relevant instruments, and open the door to new concerns. An alternative solution is to lag the suspected endogenous variables. This strategy is adopted by Cimadomo (2008), who uses the lagged output gap to study cyclically-adjusted primary balance precisely to avoid endogeneity problems.[7] It is the strategy we adopt in this paper, (i) because the additional data requirements are limited, and it is intuitively appealing, and (ii) because this approach is economically grounded. In our particular case, the simultaneous hypothesis would mean that, in the span of a year, the fiscal policy implemented at year t impacts the other endogenous variables the same year, while the latter also influence the fiscal policy implemented at year t.[8] In our view, this is a debatable assumption if we look at the timescale of the fiscal policy. National parliaments indeed usually enact budget law for year t in year $t-1$, based on a set of economic indicators available at the time of budgeting $(t-1)$, such as the GDP or the output gap. However, estimations and projections may severely diverge from what is observed *ex post* (Orphanides and van Norden (2002)), and lead to inadequate fiscal stance.[9] Therefore, We decide not to incorporate the observed *ex post* variables at time t but the observed *ex post* variables at time $t-1$, which present the optimal combination of reliability and time-proximity for policy-makers. Eventually, the time of application, of transmission and of tax collection of the fiscal policy should also be taken into account when estimating fiscal reaction function. For these reasons, we believe that that we should not worry about the simultaneous nature of our model, and the resulting endogeneity issue.

3. Results

Results from the LSDVC, the FE and the BFCE estimators are presented in Tables 4, 5 and 6, respectively. Unsurprisingly, the lagged dependent variable ($\Delta \text{pb}_{i,t-1}$) is found highly statistically

[7] Checherita-Westphal and Žďárek (2017a) prefer considering all their explanatory variables (except the debt-to-GDP ratio) contemporaneously, while Larch and Santacroce (2020) propose a mixed model.

[8] The simultaneous nature of a model may rest on the inability or the impossibility to observe used variables at a high(er) frequency. In other words, the time window selected as unit of frequency conceals a dynamic system.

[9] To overcome this problem, Cimadomo (2008) includes official projections in the fiscal reaction function.

significant in almost all the specifications, with an expected positive sign. This result underpins the idea of a persistence in fiscal policy, and our estimates are very similar to the ones found by Larch et al. (2021) in terms of magnitude. In contrast, the coefficient of our lagged output gap variables $\Delta\text{output}_{(i,t-1)}$ is positive but not statistically significant. This result may seem puzzling as it is theoretically counter-intuitive, but it corresponds to an empirical observation we share with Checherita-Westphal and Žďárek (2017a) and partially with Larch et al. (2021). To take into account a possible non-linear effect that would explain this outcome, we introduced the interaction term $(\Delta\text{output} * \text{debt} - \text{level})_{(i,t-1)}$. However, the latter is globally not statistically significant. The twin deficit hypothesis is verified with all the estimators and within all the different specifications employed. Indeed, a 1 point increase in the change of the current account leads to an average increase of the change in the primary balance of 0.17.

We would expect, regardless of the cyclical conditions, that the debt-to-GDP ratio would have a negative impact on the primary balance as the fiscal authority tends to reduce the fiscal deficit when getting close to an unsustainable situation. In contrast with this expectation, our estimates present a positive and statistically significant coefficient between the change in the primary balance in t and the change in debt-to-GDP ratio in $t-1$, with an average coefficient of 0.85. This is a counter-intuitive result, especially within the studied time-frame and accounting for the role this indicator plays in fiscal policies. Particularly startling since we also included a crisis dummy in our estimate (crisis_t) to take into account the specific response of fiscal authorities at this period. Our crisis variable appears as significantly negative (on average, -3.5), an outcome that meets our expectations.

Second and third columns of each table have been used as control estimates, the remaining estimates introduce our set of variables of interest, and proceed by adding one variable at a time. Our variables of interest set includes the change of the sovereign debt rating ($\Delta\text{sovereign rate}_{(i,t)}$), the type of government ($\text{Gov. type}_{(i,t-1)}$), the fiscal balance in percent of the tax revenues ($\Delta\text{Fiscal space}_{(i,t-1)}$), the date of election (at $t-2$, $t-1$, t, $t+1$ and $t+2$), the shadow short rate (SSR) in t and $t-1$, and eventually the date of adoption of the euro ($\text{euro}_{(i,t)}$). As it can be seen in the tables, the above-mentioned comments on the sign and significance of control variables still stand through the inclusion and exclusion of our variables of interest.

An interesting result comes from the inclusion of the sovereign debt rating. Indeed, The coefficient associated to this variable is negative and statistically significant in 2 out of 3 estimates, i.e. the LSDVC and the FE estimators (-0.161 and -0.184, respectively). This outcome is in line with what

we would expect: when the sovereign debt ratings of a country decreases, fiscal policy makers tend to reduce their fiscal deficit and adopt measures to improve the fiscal balance in order to reassure markets, hence the increase of the primary balance. This result is important since it shows that market signals are important to understand the fiscal stance and extends the work of Hanusch and Vaaler (2015).

We include political factors to take into account the well-documented political cycle. To this aim, we consider 6 different variables : the type of government and the election date at different time perspective. The coefficient associated to the type of government is positive but not significant, implying that the type of constitution of government (majority by a party or coalition) has no impact on the fiscal stance of the country. The choice to adopt different time perspective rely on the will to identify the length and the form of the political cycle. In contrast with the literature, we identify a significant coefficient associated only with the variable election date$_{(i,t+1)}$ (in average, -0.544). This coefficient is negative, inducing an increase of the deficit in the period prior the election. This result is in line with what the literature indicate and the tendency to attract votes to the detriment of fiscal sustainability. We do not observe, however, other significant coefficient associated to other time configuration of the date of election.

Finally, the coefficient associated to the shadow short rate (SSR), our proxy of the monetary policy adopted by the ECB, is significant in the three estimates we computed with a positive sign (in average, 0.446). We expected this result, which highlight an interesting relationship between the fiscal and the monetary policy. Indeed, since a decrease of the interest rate allows a lower effective funding cost, it can be an appealing trend for countries to borrow through bond markets. Inversely, a tightening of the monetary policy may have a signal effect on fiscal policy makers and act as a threat for future fiscal sustainability. Fiscal authorities, therefore, would tend to reduce the fiscal deficit to face an upcoming tightening of financial conditions. If the monetary policy implemented has a noticeable impact, the adoption of the euro has a more tenuous effect that our specifications are poorly getting. Only one of our estimators (BFCE) finds a significant effect. The coefficient associated is negative, in line with what we expect: the integration into the euro zone was accompanied with a reduction of public deficits.

4. Conclusion

This paper contributes to the literature on fiscal policy and its determinants, examining new variables that might be at play as well as proposing a novel approach of the fiscal reaction function.

Table 4: Baseline specification (LSDVC estimator)

	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$
$\Delta pb_{i,t-1}$	-0.172****	-0.171***	-0.202****	-0.171****	0.249****	-0.175****	-0.169***	-0.163***	-0.168***	-0.172****	-0.164***	-0.159***	-0.176****
	(0.0518)	(0.0520)	(0.0531)	(0.0518)	(0.0587)	(0.0518)	(0.0553)	(0.0557)	(0.0552)	(0.0520)	(0.0512)	(0.0544)	(0.0519)
Δoutput$_{(i,t-1)}$	3.64e-12	-3.63e-13	1.03e-12	-3.15e-13	3.13e-12	-2.96e-13	-7.52e-13	-2.89e-12	-6.00e-13	-4.68e-13	6.51e-12	7.56e-12	1.14e-12
	(6.40e-12)	(2.42e-11)	(2.64e-11)	(2.43e-11)	(9.09e-11)	(2.42e-11)	(2.56e-11)	(2.60e-11)	(2.47e-11)	(2.43e-11)	(2.64e-11)	(2.73e-11)	(2.42e-11)
Δcurrent account$_{(i,t-1)}$	0.117**	0.117**	0.0797	0.117**	0.103	0.120**	0.119**	0.125**	0.122**	0.116**	0.111**	0.116**	0.116**
	(0.0520)	(0.0522)	(0.0584)	(0.0525)	(0.197)	(0.0522)	(0.0510)	(0.0544)	(0.0536)	(0.0524)	(0.0505)	(0.0531)	(0.0523)
crisis$_t$ crisis	-3.565****	-3.558****	-3.320****	-3.563****	-3.686***	-3.589****	-3.588****	-3.540****	-3.559****	-3.562****	-3.086****	-3.540****	-3.573****
	(0.362)	(0.363)	(0.403)	(0.364)	(1.378)	(0.363)	(0.379)	(0.398)	(0.409)	(0.364)	(0.399)	(0.391)	(0.364)
Δdebt $-$ level$_{(i,t-1)}$	0.0838****	0.0838****	0.0680***	0.0830****	0.0681	0.0849****	0.0827****	0.0861****	0.0843****	0.0834****	0.0932****	0.0851****	0.0844****
	(0.0233)	(0.0233)	(0.0260)	(0.0236)	(0.0873)	(0.0232)	(0.0241)	(0.0248)	(0.0253)	(0.0234)	(0.0232)	(0.0241)	(0.0233)
(Δoutput $*$ debt $-$ level)$_{(i,t-1)}$		5.11e-14	3.68e-14	4.96e-14	-7.02e-15	5.71e-14	5.30e-14	9.19e-14	5.55e-14	5.25e-14	-1.17e-14	-3.79e-14	3.61e-14
		(2.97e-13)	(3.24e-13)	(2.98e-13)	(1.11e-12)	(2.97e-13)	(3.16e-13)	(3.24e-13)	(3.08e-13)	(2.98e-13)	(3.20e-13)	(3.27e-13)	(2.98e-13)
Δsovereign rate$_{(i,t)}$			-0.161**										
			(0.0706)										
Gov. type$_{(i,t-1)}$				0.155									
				(0.562)									
ΔFiscal space$_{(i,t-1)}$					-0.109**								
					(0.0475)								
election date$_{(i,t-1)}$						0.398							
						(0.290)							
election date$_{(i,t)}$							0.102						
							(0.310)						
election date$_{(i,t+1)}$								-0.532*					
								(0.309)					
election date$_{(i,t+2)}$									0.147				
									(0.329)				
election date$_{(i,t-2)}$										0.0619			
										(0.283)			
ΔSSR$_{(i,t)}$											0.451****		
											(0.134)		
ΔSSR$_{(i,t-1)}$												0.00842	
												(0.144)	
euro$_{(i,t)}$													-0.401
													(0.397)
N	333	333	333	333	333	333	316	312	311	333	330	329	333

Note : Robust standard errors in parentheses, $*: p < 0.1, **: p < 0.05, ***: p < 0.01, ****: p < 0.001$. The estimator used is *á la* Anderson-Hsiao, using 1000 repetitions to calculate the bootstrap variance-covariance matrix for LSDVC.

Table 5: Baseline estimation (FE estimator)

	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$
$\Delta pb_{i,t-1}$	-0.209***	-0.209***	-0.240****	-0.209***	0.249	-0.212***	-0.208***	-0.201***	-0.206***	-0.209***	-0.200***	-0.197***	-0.214***
	(0.0599)	(0.0604)	(0.0556)	(0.0603)	(0.326)	(0.0608)	(0.0602)	(0.0595)	(0.0613)	(0.0587)	(0.0644)	(0.0670)	(0.0608)
$\Delta output_{(i,t-1)}$	3.69e-12	3.95e-13	1.68e-12	4.41e-13	3.13e-12	4.83e-13	1.82e-14	-2.02e-12	1.14e-13	2.88e-13	7.81e-12	8.18e-12	1.93e-12
	(2.89e-12)	(1.72e-11)	(1.73e-11)	(1.70e-11)	(1.77e-11)	(1.72e-11)	(1.73e-11)	(1.72e-11)	(1.77e-11)	(1.76e-11)	(1.96e-11)	(1.81e-11)	(1.72e-11)
$\Delta current\ account_{(i,t-1)}$	0.118*	0.118*	0.0799	0.118*	0.103	0.121*	0.120*	0.127*	0.124*	0.117*	0.111*	0.118*	0.117*
	(0.0592)	(0.0594)	(0.0533)	(0.0597)	(0.0648)	(0.0583)	(0.0623)	(0.0601)	(0.0656)	(0.0604)	(0.0632)	(0.0583)	(0.0589)
$crisis_t$	-3.651****	-3.647****	-3.394****	-3.651****	-3.686****	-3.676****	-3.680****	-3.630****	-3.649****	-3.650****	-3.159***	-3.625****	-3.660****
	(0.769)	(0.775)	(0.647)	(0.778)	(0.792)	(0.791)	(0.773)	(0.773)	(0.786)	(0.773)	(0.868)	(0.769)	(0.777)
$\Delta debt - level_{(i,t-1)}$	0.0835****	0.0836****	0.0659****	0.0828****	0.0681***	0.0848****	0.0824****	0.0858****	0.0841****	0.0831****	0.0922****	0.0849***	0.0841****
	(0.0173)	(0.0173)	(0.0140)	(0.0174)	(0.0196)	(0.0153)	(0.0164)	(0.0176)	(0.0168)	(0.0171)	(0.0162)	(0.0231)	(0.0174)
$(\Delta output * debt - level)_{(i,t-1)}$		4.21e-14	2.75e-14	4.07e-14	-7.02e-15	4.79e-14	4.38e-14	8.12e-14	4.73e-14	4.35e-14	-2.39e-14	-4.65e-14	2.69e-14
		(1.99e-13)	(2.00e-13)	(1.96e-13)	(2.13e-13)	(1.97e-13)	(2.01e-13)	(1.92e-13)	(2.02e-13)	(2.03e-13)	(2.17e-13)	(2.05e-13)	(1.96e-13)
$\Delta sovereign\ rate_{(i,t)}$			-0.184*										
			(0.0895)										
$Gov.\ type_{(i,t-1)}$				0.150									
				(0.263)									
$\Delta Fiscal\ space_{(i,t-1)}$					-0.109								
					(0.0812)								
$election\ date_{(i,t-1)}$						0.400							
						(0.303)							
$election\ date_{(i,t)}$							0.0981						
							(0.347)						
$election\ date_{(i,t+1)}$								-0.527					
								(0.318)					
$election\ date_{(i,t+2)}$									0.141				
									(0.224)				
$election\ date_{(i,t-2)}$										0.0609			
										(0.288)			
$\Delta SSR_{(i,t)}$											0.451***		
											(0.135)		
$\Delta SSR_{(i,t-1)}$												0.0140	
												(0.188)	
$euro_{(i,t)}$													-0.429
													(0.260)
_cons	0.492****	0.492****	3.764**	0.480****	0.546****	0.393***	0.496****	0.629***	0.451***	0.477***	0.558****	0.503***	0.812***
	(0.106)	(0.107)	(1.666)	(0.102)	(0.124)	(0.114)	(0.0864)	(0.186)	(0.145)	(0.141)	(0.100)	(0.129)	(0.231)
N	333	333	333	333	333	333	316	312	311	333	330	329	333

Note :Robust standard errors in parentheses, $* : p < 0.1, ** : p < 0.05, *** : p < 0.01, **** : p < 0.001$. We configure our estimation method to take into account possible cross-section-specific variance, and employ a burn-in initialization.

Table 6: Baseline estimation (BCFE estimator)

	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$	$\Delta pb_{i,t}$
$\Delta pb_{i,t-1}$	-0.164*	-0.163*	-0.192***	-0.162**	0.327	-0.168**	-0.157**	-0.159**	-0.153*	-0.165**	-0.160**	-0.145*	-0.168**
	(0.0843)	(0.0845)	(0.0716)	(0.0786)	(0.352)	(0.0737)	(0.0766)	(0.0787)	(0.0792)	(0.0813)	(0.0750)	(0.0864)	(0.0808)
$\Delta output_{(i,t-1)}$	4.54e-12	2.01e-12	3.18e-12	2.03e-12	3.02e-12	2.07e-12	1.64e-12	-6.40e-12	-2.40e-12	1.90e-12	6.85e-12	7.89e-12	3.66e-12
	(8.74e-12)	(4.05e-11)	(4.46e-11)	(4.05e-11)	(3.77e-11)	(4.65e-11)	(4.88e-11)	(5.08e-11)	(4.88e-11)	(3.91e-11)	(4.90e-11)	(4.28e-11)	(4.58e-11)
$\Delta current\ account_{(i,t-1)}$	0.116*	0.116*	0.0796	0.116*	0.102	0.118**	0.120**	0.120**	0.130*	0.115*	0.114*	0.110*	0.114*
	(0.0611)	(0.0599)	(0.0528)	(0.0610)	(0.0710)	(0.0574)	(0.0586)	(0.0605)	(0.0754)	(0.0642)	(0.0648)	(0.0589)	(0.0613)
$crisis_t$	-3.534****	-3.530****	-3.295****	-3.530****	-3.556****	-3.562****	-3.554****	-3.507****	-3.635****	-3.534****	-3.056****	-3.536****	-3.542****
	(0.739)	(0.766)	(0.596)	(0.722)	(0.791)	(0.776)	(0.707)	(0.731)	(0.792)	(0.760)	(0.918)	(0.836)	(0.776)
$\Delta debt - level_{(i,t-1)}$	0.0908****	0.0909****	0.0740****	0.0905****	0.0634***	0.0919****	0.0824****	0.0899****	0.0876****	0.0904****	0.0905****	0.0844***	0.0919****
	(0.0196)	(0.0205)	(0.0166)	(0.0203)	(0.0214)	(0.0185)	(0.0189)	(0.0194)	(0.0205)	(0.0197)	(0.0184)	(0.0255)	(0.0202)
$(\Delta output * debt - level)_{(i,t-1)}$		3.23e-14	1.93e-14	3.15e-14	-7.63e-15	3.84e-14	2.31e-14	1.36e-13	6.67e-14	3.38e-14	-2.01e-14	-3.41e-14	1.63e-14
		(4.14e-13)	(4.56e-13)	(4.10e-13)	(4.22e-13)	(4.37e-13)	(4.85e-13)	(5.09e-13)	(4.65e-13)	(4.03e-13)	(5.02e-13)	(4.57e-13)	(4.63e-13)
$\Delta sovereign\ rate_{(i,t)}$			-0.171										
			(0.105)										
$Gov.\ type_{(i,t-1)}$				0.104									
				(0.329)									
$\Delta Fiscal\ space_{(i,t-1)}$					-0.113								
					(0.0856)								
$election\ date_{(i,t-1)}$						0.393							
						(0.312)							
$election\ date_{(i,t)}$							0.0794						
							(0.317)						
$election\ date_{(i,t+1)}$								-0.557*					
								(0.335)					
$election\ date_{(i,t+2)}$									0.241				
									(0.267)				
$election\ date_{(i,t-2)}$										0.0719			
										(0.264)			
$\Delta SSR_{(i,t)}$											0.438***		
											(0.135)		
$\Delta SSR_{(i,t-1)}$												-0.0127	
												(0.195)	
$euro_{(i,t)}$													-0.436*
													(0.246)
N	331	331	331	331	331	331	315	299	283	328	328	327	331

Note : Robust standard errors in parentheses, $* : p < 0.1, ** : p < 0.05, *** : p < 0.01, **** : p < 0.001$.

Hitherto, several forms of fiscal reaction functions have been investigated to explain the observed fiscal span in Europe, but to our knowledge none have investigated the potential leads and lags in the fiscal policy reaction. Our approach mixed a forward-, backward- and contemporary-looking ability, allowing different response time of the policy makers.

We also incorporate in our FRF new variables such as the sovereign credit rating and the shadow short rate. The former had been very rarely used to study countries fiscal behavior, despite the significant importance it can have on markets and its relative stability. The latter allows to link the monetary policy and the fiscal policy, and has surprisingly not been extensively studied in this context.

We estimate our model with three different estimators adapted to the specificity of our data set: the bias-corrected LSDV estimator, a boostrap corrected fixed-effects estimator for dynamic panel-data and the fixed-effect estimator. We used a sample of 19 European countries over the period 1991-2019, all members of the Euro zone and members of the European Union. The time-frame covers important moments of the European integration as well as global and regional crises.

Our findings corroborate our initial hypothesis: a fiscal reaction function should mix lagged and lead elements to take into account the backward- and forward-looking ability of policy makers. Taking into account this aspect, we notice that the political cycle is present in European countries and impacts fiscal policies upstream. It has also allowed us to limit the impact of monetary policy on fiscal policy, which reacts swiftly to changes in the ECB decision or direction. With a positive impact of the shadow short rate on the primary balance, expansionary monetary policy seems to give more flexibility to the fiscal policy by allowing broader fiscal deficits for a reduced borrowing cost.

Finally, some policy guidelines can be deduced from our paper. In a time of uncertainty vis-à-vis the fiscal sustainability of some EU countries, monetary policy makers can have an active role by tightening the financing conditions on the markets and suggesting an increase of the interest rate in the upcoming years. Ratings agencies have also a substantial part to play in maintaining sound fiscal practice.

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