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# Does the level of financial development matter for the fiscal response? A PSTR approach for the EU and selected OECD countries

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A PSTR Approach for the EU and selected OECD Countries**

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# Does the level of financial development matter for the fiscal response?

## A PSTR Approach for the EU and selected OECD Countries

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### Abstract

This paper empirically studies the role of financial development in the fiscal response function by distinguishing high and low financial development regimes based on a data driven selection mechanism and investigating two groups of economies, European Union (EU) members and OECD countries from 2000 to 2019. Applying the panel smooth transition regression to separate two regimes based on the status of financial development we find a threshold of about 0.60 of financial development (FD) on average in the EU, a little higher in the OECD. Our results indicate that the stance of financial development matters for fiscal policy design and business cycle behavior. The response effectively differs for low financial development regime situations compared to high financial development regimes, both, with regard to debt sustainability as well as the output gap in the EU and the OECD, too. While in the low FD regime debt indicates to be sustainable and the business cycle performs pro-cyclically, in high FD regimes the picture changes to a more mixed behavior including debt non-sustainability and counter-cyclical output manner. This holds true for both, the EU as well as the OECD. Thus, our results indicate that financial markets do fuel (fiscal) policy behavior. Too much financial development can influence particularly the debt reaction and the business cycle.

JEL: H63, E62

Keywords: Debt sustainability, fiscal response function, financial development, panel smooth transition regression

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# 1 Introduction

The financial and debt crisis 2007/2010 showed the vulnerability of the economies in Europe and around the globe and revealed the challenges modern economies are exposed to with regard to their debt and fiscal policy design. Growth rates declined, unemployment rose and public resources in terms of high deficits became important to cushion the downswing of the economies but resulted in high or increasing debt ratios. Countries faced severe circumstances considering their fiscal policy in a difficult economic environment.

The status of financial development, access to financial markets and the role of fiscal policy turned out to be important factors how economies coped with the pressure that they encountered. This also became visible in the following crises during the COVID-19 pandemic and recently in the war-related and energy difficulties in Europe. Households, governments and firms faced severe challenges during the pandemic - socially as well economically for instance by lockdowns. Support such as against unemployment, for health care or on economic affairs put the fiscal stance under pressure in many countries. Deficits rose and public debt jumped to unprecedented levels: for the first time in history government debt reached the size its economy in the Euro area by the end of 2020, see AMECO (2021) UDGG series data base. For initializing and realizing the huge required liquidity for the support packages and recovery programs financial markets played an important role. The development of financial institutions and markets is an essential matter for the economic situation and progress of an economy. Financial development in terms of size and liquidity of the financial market, the access of individuals and firms to receive admission to services and products and the efficiency of the participating institutions reveal the measure of the financial status. Such information is summarized in the Financial Development Index (FDI) by the IMF for example. It captures a measure of financial depth, access and efficiency in a single number ranging from 0 to 1. For instance in the EU the average FDI is 0.57. Low values of about 0.3 on average were reached by the Baltics Estonia and Latvia, while the highest average value of financial development of over 0.85 was realized by Spain. Followed by the Netherlands, Sweden, France, Italy and Germany. With regard to the OECD economies it shows that the average financial development was particularly high in Switzerland (0.94) with its distinct banking and financial market sector, also high average financial development values are visible in Australia, the US and the UK, cf. figures 1 and 2 and table 4 respectively. So, there could be potential effects that shape and influence the economy and also fiscal policy behavior - and the other way around. The interdependency calls for a closer investigation. Thus, it is an important issue to combine the studies of fiscal policy and financial development. As put by Christine Lagard: fiscal policy in terms of public tax and spending design is an essential instrument to achieve objectives such as enhancing financial inclusion so that everyone has access to credit and financial markets, cf. Clements et al. (2015).

The fiscal policy design is often investigated by the fiscal response function, which captures the reaction of a government to changes in the debt situation and also allows to study the reaction to business cycle variations. How does fiscal policy in terms of the primary balance (revenues less expenditures without interest payments) react to changes in public debt? And in the same vain: how does it respond to changes in the business cycle

(calculated as the output gap)? And how does the status of the financial development determine or shape these relationships?

With this paper we contribute to the fiscal response literature in several ways. First, we combine the relation between financial development and fiscal policy and particularly focus on the role of the status of financial development for the fiscal response function. We study debt sustainability and business cyclicity dependent on the status of financial development in different scenarios and samples/selection of countries with financial development as transition variable. In particular we distinguish (data-driven) regimes with high and low financial development and study the fiscal reaction function in those scenarios allowing to draw conclusions on differences in the response based on the distinction of the financial development situation. To our knowledge, this is a new feature in the fiscal response and policy research. Meaning, our second contribution is application of a new modern methodology panel smooth transition regression (PSTR) allowing to conduct our research question adequately. PSTR methodology features smooth changes in the regression parameters from one regime to another and therefore captures asymmetrical or non linear relationship between variables very well. Additionally, the standard linear fixed effects model assumes regression parameter homogeneity which does not always hold especially if there is evidence of heterogeneity in the panel dataset. PSTR methodology is suitable for heterogeneous panel datasets since it refrains from pooling slope parameters.

We conduct research with this estimation strategy for 24 EU and 27 OECD countries for the time period 2000 to 2019. Our results for the EU show debt sustainability in both regimes and pro-cyclical behavior in the low financial development regime and counter-cyclical policy in high financial development. Once controlled for the financial crisis in the second regime the situation changes to unsustainable debt and pro-cyclical behavior. Thus, it seems that it is important to interpret the situation in relation with the included variables to draw conclusions for the fiscal policy implications. Regarding the OECD group debt is only sustainable in the low financial regime and becomes unsustainable in the second regime. Again, business cycle reaction changes from pro- to counter-cyclical behavior with the increase in financial development. Furthermore, controlling for the crises, high financial development induces unsustainable and pro-cyclical behavior. Because of the heterogeneity the effects in the OECD sample are not as pronounced as in the EU group. Again, it seems to be important to interpret the effects in relation to the other included controls. Finally, our results indicate that financial markets fuel fiscal policy behavior. Too much financial development can influence particularly the debt reaction and the business cycle.

The rest of the paper is structured as follows: section two provides a literature overview. Section three briefly introduces the methodology and describes the data set. Section four presents and discusses the results and section five concludes.

## 2 The interactions between fiscal policy and financial sector

The relationship between fiscal policy and financial sector has been largely documented in the economic literature. However, there is no clear evidence of the direction of the causality, and over the time, the theoretical framework and the empirical research have been pointed towards the existence of circular linkages. Tobin (1969) is among the firsts who suggested that fiscal policy can affect asset market, both, directly and indirectly in a closed economy framework. The direct transmission is made through the government debt, while the indirect channel is represented by the effects fiscal policy can have on the goods and labour markets which can further influence the accumulation and the stock of capital, the income, the prices and the wages, and, in the end, the asset market. In turn, the changes in the asset prices and interest rates can exert an impact on goods and labour markets as well on capital accumulation and capital stock. Based on the rational expectations hypothesis and on additional two assumptions: (i) the asset prices are determined by the current and anticipated output and income; (ii) the asset prices are the main determinants of the aggregate demand and output, Blanchard (1981) studied the effects of fiscal measures by taking into consideration the stock market response to changes or to announcement of changes in the fiscal policy. He pointed to an ambiguous reaction of the stock market to fiscal policy announcements whether there is "bad" or "good" news and also revealed the "perverse" effects on output, which manifest in-between the time of the announcement and the moment when the fiscal measure is actually implemented. He showed that stock market is reactive and because of its movements it can alter the initial effects of the fiscal policy. In case of a "bad" news, the stock market drops down at the time of the announcement because of the anticipation of a future increase in the short-term interest rates after the fiscal measure is enforced. Consequently, the private spending decreases while the government spending remains unchanged (because the fiscal measure has not been implemented yet) and, therefore, the output will fall in advance. The term structure will also be positive and upward sloped because stock market expects an increase in the long-term interest rate. When fiscal measure is actually put to action and afterwards, the output will increase as well as the short-term interest rates. Still, the term structure will remain positive but its slope will decrease as the economy is heading towards the steady state. If fiscal news is perceived by the stock market as "good", then it will be no "perverse" effect in-between. In a bullish stock market, the shares prices will reflect the positive expectations of growing profits which offset the anticipation of higher interest rates. At the time of the implementation, the output will increase to a greater extent. In a subsequent paper, Blanchard (1984) also brought into discussion the "new view" on large fiscal deficits that can be more damaging than helpful for the economy recovery and pointed out that traditional approach on the effects of fiscal expansions had ignored sustainability issues which were associated with sizeable and prolonged deficits. In such situations, the increased real interest rates as consequence of anticipated growing deficits can reverse the expansionary fiscal policy and turn it into a contractionary one. He also highlighted that what matters is the agents' perception on the sustainability of a fiscal program which is not currently unsustainable. Related to these aspects, Laubach (2009) stressed that assessing the quantitative impact of fiscal policy on long-term interest rates might be impeded by how well these effects are isolated from other factors affecting

the interest rates. He explained that the correlation between budget deficit and interest rate can be negative, although the partial impact is positive, because of the fall in the interest rates due to monetary easing which offsets the initial rise of the interest rate as an effect of growing deficit led by automatic stabilizers during recessions. He also showed the significant larger impact projected budget deficits have on long-horizon forward rates compared to the impact determined by the projected government debt. With this theoretical framework as a starting point, there has been a considerable amount of studies empirically examining financial market responsiveness to: fiscal actions - tax cuts and/or spending increase - Elmendorf and Reifschneider (2002); fiscal adjustments - Akitoby and Stratmann (2008), Ardagna (2009), Baldacci et al. (2011); fiscal shocks - Arin et al (2009), Agnello and Sousa (2010), Afonso and Sousa (2011); fiscal news - Darrat (1988), Laopodis (2009).

There is also an important body of research revealing the various and numerous linkages between fiscal policy and financial development. Caballero and Krishnamurthy (2004) brought to attention that the financial depth matters for the fiscal policy and its use for macro-stabilisation purposes. They observed distinct fiscal behaviours resulting in significant different fiscal positions in countries with various degrees of access to funds supply. They showed there are countries which can run large fiscal deficits without facing the risk of a crisis and can also conduct expansionary fiscal policy during economic downturns and countries which cannot. They explained these distinctions by resorting to the "crowding-out" hypothesis and identified two transmission channels. On one hand, the increasing government debt reduces country's aggregate liquidity because of the decrease in the private assets productivity, which, eventually, leads to a raising liquidity premium. On the other hand, poor fiscal discipline can increase investors fears on government fiscal irresponsibility, which can further deteriorates the sovereign ratings. Regardless of which channel is transmitting the effects, the outcome is similar and translates into a narrowing financial depth, which is more pronounced in the emerging markets, especially during the times of crisis. Because of the limited financial depth, fiscal policy cannot be use as a counter-cyclical policy tool, and makes Keynesian standard policy approaches to reverse.

Kumhof and Tanner (2005) also brought to discussion some particular aspects describing the relation between fiscal policy and financial intermediation and contributed to a better understanding of these interactions. They found that financial intermediation in the developing countries had largely relied on the banking system, which, in turn, had decided upon holding a great amount of government debt securities which served as a safe asset. This situation had been caused by a weak legal and institutional infrastructure which made the access of the private sector to credit difficult and increased banks exposure to a higher credit risk. Therefore, for these group of countries a prudent government debt management had become crucial for their financial stability. But, on the other hand, it also played an important role in the development of these financial systems because it represented the backbone of the construction of the fixed-income securities market by providing the institutional, regulatory and financial as well as it represented an informational benchmark for traders and investors.

Hauner (2006) contributed to this debate by tossing the other side of the coin and showed that continuously

large government sector borrowings can have adverse effects on the financial depth. During the 90s, the external indebtedness had rapidly declined in the middle-income countries against the backdrop of replacing external with domestic borrowings. He found that even though the banks mainly lending to the public sector were relatively more profitable, they were at the same time less efficient, which eventually might negatively affect financial development and harm financial deepening. This is because inefficient banks that have invested in more profitable public sector credit have had too little stimulus in further developing the banking system. Another finding is that too much public sector bank borrowing hurts financial development. The study points towards larger positive effects on the liquidity, on the size of the banking system and also on the private sector lending for the group of countries with lower bank credit to the public sector ratio.

IMF (2007) discusses fiscal policy response to the effects generated by financial globalization. It is evident that globalization has led to financial openness and increasing capital flows and facilitated the access to growing funds supply. Governments borrowing and lending at international scale played an important role in favoring and speeding financial markets integration. However, financial globalization and the accompanying financial deepening have consequences that require fiscal policy to respond appropriately. For instance, financial deepening can reduce revenue volatility because it provides the business sector with a greater ability to smooth its income in response to shocks. On the other hand, the financial sector tends to be more volatile in comparison with other sectors and can be a source of higher volatility for the revenues. In the end, this will have implications for the tax policy. The financial crisis in 2007-08 had showed that financial sector generates contingent liabilities for the governments which arise from pressures to bail out insolvent financial institutions in order to avoid contagion effects. Governments policies which increase the moral hazard by creating bail-out expectations can also be responsible for a more vulnerable financial sector. The role played by financial markets in maintaining fiscal discipline is reflected by the impact of budget deficits on the increasing sovereign risk premium. However, market response is quite modest for a large range of fiscal outcomes and becomes stronger for higher deficits/debt which exceeds a certain threshold. In this regard, financial globalization contributes to the improvement of domestic market discipline because international financial markets are monitoring closely fiscal liquidity and solvency, which will stimulate the governments to pursue sound fiscal policies in order to sustain market confidence and access to external funds supply. The flip side shows that in the short run financial globalization may weaken fiscal discipline and make governments deciding to postpone fiscal adjustments because of the ready access to external financing. Globalization and financial deepening can promote economic growth and, consequently, the debt tolerance can increase. This benefit is more likely to arise in countries with well developed financial systems which proved they are committed to fiscal discipline and pursued sound fiscal policies.

In terms of fiscal stabilisation, IMF (2007) and Spilimbergo, Symansky and Schindler (2009) showed the ambiguous impact of financial development on the size of fiscal multipliers, which depends on the degree of the financial development and on governments ability to finance their deficits. On one hand, they stressed out the larger multiplying effect in countries with poor financial markets which limits the ability for consumption



and investment smoothing. On the other hand, they pointed out that governments' limited access to financial markets can reduce the size of fiscal multiplier because they will have to issue debt at higher interest rates which decreases the multiplying effect. In case of financially repressed countries, because governments will issue bonds only to domestic savers, hence lowering the financing costs, the fiscal multipliers will be larger. Moreover, in case of less developed financial markets, government will be forced to pursue pro-cyclical fiscal policy since they do not have easy access to funds supply as opposite to well-developed financial markets where counter-cyclical fiscal policies are becoming more of an option. In addition, higher financial depth may diminish the impact of governments borrowings on domestic interest rates and sovereign risk premium, thus reducing the crowding-out effect on investments and making macroeconomic stabilization more effective.

The study of fiscal response credited to the tax-smoothing model introduced by Barro (1979) and later promoted by Bohn (1998) as fiscal reaction function (FRF) used to assess fiscal sustainability has been subject to a number of developments aimed at better capturing the debt and output stabilization response of governments. One of these developments is to augment the FRF model and to include certain covariates that measure financial markets movements in order to examine how fiscal response may be impacted by the financial sector. In this regard, building on the standard fiscal policy reaction function, Tagkalakis (2011) brought his contribution by shedding some light on governments fiscal behaviour to assets price changes. His findings suggest financial markets have a significant impact on fiscal position. An increase in the asset prices leads to an improvement of the primary balance, with a response reflecting both an increase in government revenues as well as cuts of government spending. The results also indicated both, an automatic and a discretionary fiscal response to changes in the equity prices and stressed that a steeper yield curve slope increases the fiscal discipline determining governments to pursue expenditure based fiscal consolidation. In addition, Tagklakis pointed out that governments should take into consideration the movements of the financial markets because they might reflect concerns on country's sustainability as well as they should be more attentive to assets prices because they could carry relevant information on the economic conditions and help policy makers to take decisions to build up fiscal buffers during good times. Legrenzi and Milas (2013) also showed that fiscal authorities behaviour during "good" and "bad" times varies with the level of debt, business cycle and financial markets pressure. During the periods of financial pressures, policy-makers lower the debt ceiling above which they decide to take corrective actions. This result suggest that financial markets are more effective than the excessive deficit procedure in convincing the EU member states to correct fiscal imbalances. We did not find evidence on how financial development can affect the fiscal reaction function of governments. Therefore, our paper can contribute to bridging this gap in the literature.

### 3 Econometric methodology

Regarding our econometric methodology, we specify a panel fixed effect regression model below:

$$y_{it} = \alpha_i + \beta_i x_{it} + \mu_i Z_{it} + U_{it} \quad (1)$$

Where  $i$  and  $t$  indicates the cross sectional and time series dimension in the panel respectively.  $y$  is the dependent variable (cyclically adjusted primary balance),  $x$  is our covariate of interest (debt to GDP ration) and  $Z$  represents a vector of control variables which are combination of business cycle variables, transitory government spending, monetary and international trade variables which are all assumed to be exogenous.  $\alpha$  represents the individual heterogeneity in the panel and  $u$  is the error term which is assumed to be i.i.d with a zero mean and a constant variance.  $\beta$  and  $\mu$  are the coefficient of the covariates and control variables respectively which are not constant by allowed to vary across the individual units in the panel. This can be justified by the fact that the pooling the slope (coefficient) or assuming slope homogeneity is not always econometrically feasible due to heterogeneity among the individuals in the panel dataset. Secondly, the possibility of structural changes in the data which could be due to changes in policy decisions for instance implies a violation of the homogeneity assumption in the model. Regime switching models are therefore desirable or appealing in this context since they take care of data heterogeneity better.

To answer our research question, we apply a regime-switching model to (1) in the panel data context. We resort to Panel Smooth Transition Regression (PSTR) model according to Gonzalez et al. (2017), to estimate our model. Smooth transmission from one regime to another is justifiable by the fact that there is usually some form of inertia in policy decisions. Therefore the effect of changes/reverse in policy decisions are expected to change gradually over time instead of abruptly. Furthermore, all the data points for individual countries (for instance) are not restricted to stay in a single regime, but rather switch between the number of regimes based on the value of the transition variable. PSTR model therefore more appealing and more realistic as compared to for instance other threshold regression models.

A two regime PSTR is specified as

$$y_{it} = \mu_i + \beta_0 x_{it} + \beta_1 x_{it} g(q_{it}; \gamma, c) + u_{it} \quad (2)$$

$g(q_{it}; \gamma, c)$  is the transition function which is observable, continuous and bounded. The regime switching model is conditioned on the transition variable  $q_{it}$ ,  $c$  denotes the vector of location parameter and  $\gamma$  determines the slope of the transition function.

In order to captured the transition function, Teräsvirta (1994 and 1998) used a logistics regression function so that the function is bounded between 0 and 1 (where zero depicts one extreme regime and 1 the other regime) as depicted below

$$g(q_{it}; \gamma, c) = (1 + \exp(-\gamma \prod_{j=1}^m (q_{it} - c_j)))^{-1} \quad (3)$$

determines The smoothness of the transition from one regime to another is captured by  $\lambda > 0$ . The location parameter  $c$  depicts the threshold between the two extreme regimes with transition functions  $g(q_{it}; \gamma, c) = 0$  and  $g(q_{it}; \gamma, c) = 1$ . The index  $m$  determines the number of regimes and could be more than one depending on the variations in the parameter. For instance when  $m = 1$ , the model is characterised by two extreme regimes associated with high and low values of the transition variable ( $q_{it}$ ). In that case the coefficients from

equation 1 switches between  $\beta_0$  and  $\beta_0 + \beta_1$  and the change is centred around  $c_1$ . When  $m = 2$  the transition function attains its minimum at  $(c_1 + c_2)/2$  and attains its maximum at 1 for both low and high values of the transition variable.

To ensure the model is robust against serial correlation (based on the the autocorrelation and partial autocorrelation function), we apply Feasible Least Squares (Cochrane Orrcutt approach). The idea is to estimate an autocorrelation coefficient based on the residuals and pre-multiply the resulting coefficient by the design matrices and the dependent variable in order to transform the residuals. This leads to a model with homoscedastic and uncorrelated errors (Puetz and Kneib, 2018).

Finally we pay attention to the issue of cross-sectional dependence (CSD) in the panel, which is likely in this context because the countries in the panel (especially the EU group) are linked economically and geographically. Hence there is the tendency that such countries respond to shocks in a similar manner and hence the presence of unobserved common factor in the residuals. This leads to inconsistent standard errors. Econometrically the problem of CSD can be corrected by augmenting the model with cross sectional averages for the covariates and dependent (Pesaran, 2006).

### 3.1 Data set

Two main datasets were used for the study, namely European Union dataset and OECD dataset. The EU datasets made up of 24 countries were obtained from the EU AMECO website whilst data used for OECD countries (27 countries) was obtained from OECD website. Both datasets span a period of 20 years (from 2000 o 2019). The variables include, cyclically adjusted primary balance *CAPB*, as a proxy for discretionary fiscal policy variable and debt to GDP ratio, *debt ratio*, as our covariate of interest. We control for the business cycle using the output gap, *output gap*, which is a deviation of actual output from potential output after filtering the trend with the HP filter. Similarly, we control for temporary government spending/outlays by constructing government a expenditure gap which represents the deviation of government spending from potential spending called *Govt exp gap*. We control for the impact of monetary policy using interest rates and inflation. Regarding interest rates, we use central bank short-term interest rates, *Interest rates*, for both EU (AMECO website) and OECD (OECD website). As a proxy for inflation, *Inflation*, we compute the log changes in the GDP deflator for the EU and percentage changes consumer price index for OECD due to data availability. We also controlled for the influence of international trade, *trade*, using net export variable. Our transition variable is given by the financial development index (FDI). The econometric model is conditioned on the FDI so that we are able to distinguish between low level of FDI and high level of FDI in order to answer the research question.

One of the main novelties of this paper is the inclusion of financial development in fiscal policy analysis. Such information on financial depth is summarized for instance in the Financial Development Index (FDI) by the IMF, cf. IMF (2022). It captures a measure of financial depth, access and efficiency in a single number ranging from 0 to 1. For instance in the EU the average is 0.57. Low values of about 0.3 on average were reached by the Baltics Estonia and Latvia, while the highest average value of financial development of 0.85

was realized by Spain. Followed by the Netherlands, Sweden, France, Italy and Germany. With regard to the OECD economies it shows that the average financial development is larger with an average value of 0.67 and was particularly high in Switzerland of 0.94. Switzerland is shaped by a distinct banking and financial market sector, also high average financial development values are visible in Australia, the US and UK. Table 4 provides the summary statistics of the FDI for the OECD (incl. the EU countries). Figures 1 and 2 plot the average financial development in our EU and OECD sample respectively.

Table 1 summarizes the information on the included variables in percentages, both for the EU and the OECD sample respectively. It shows that the average (lagged) public debt ratio was a little less than 60% in the EU, which matches the Maastricht Treaty target, while it was above 75% on average in the OECD countries. The primary balance ratio is slightly positive in the EU, indicating a budget surplus, while it shows a primary deficit on average in the OECD sample. The government expenditures are on track (0) in the EU but slightly miss the trend in the OECD. The economic output performed below the target (deficits/ negative output gaps) in both samples and the inflation was about 2% in both groups - which corresponds the EBC target. Both, the EU and the OECD are characterized by a high degree of openness (trade). As mentioned above, in the EU the average financial development index is 0.57 and a little higher in the OECD sample 0.67. The interest rates range in a common area, however, the 50% max in the EU had taken place in Romania in the early 2000s, then it subsequently dropped.

Table 1: Summary statistics

<i>Variables</i>	<i>EU</i>				<i>OECD</i>			
	mean	median	min	max	mean	median	min	max
<i>lagged debt-ratio</i>	58.397	52.383	3.765	186.239	75.694	67.008	6.654	234.380
<i>Primary balance</i>	0.011	0.230	-27.692	9.717	-0.476	0.014	-26.090	6.140
<i>Govt exp gap</i>	0.0000	-0.2047	-36.706	52.882	-0.026	-0.073	-4.088	15.613
<i>lagged output gap</i>	-0.1023	0.308	-16.255	13.748	-0.322	-0.301	-12.833	17.145
<i>Inflation</i>	2.651	1.939	-10.234	35.894	2.043	1.925	-4.478	15.402
<i>lagged trade</i>	98.37	99.30	60.70	114.90	99.75	99.34	75.07	142.45
<i>Interest rates</i>	2.75	2.10	-0.5	50.7	2.15	1.727	-0.819	18.875
<i>Financial dev index</i>	0.567	0.622	0.104	0.902	0.674	0.716	0.169	1.000

## 4 Results and Discussion

Firstly, we compute a correlation matrix for all our variables to understand the relationship and direction between the variables based on the Pearson correlation coefficient in Tables 5 and 6 in the appendix. For both EU and OECD data, there exists a positive relationship between the primary balance and lagged debt, financial development and trade. The remaining variables have a negative relationship with the primary balance. However, the strength of the correlation is not very high as can be seen from the table, ruling out the

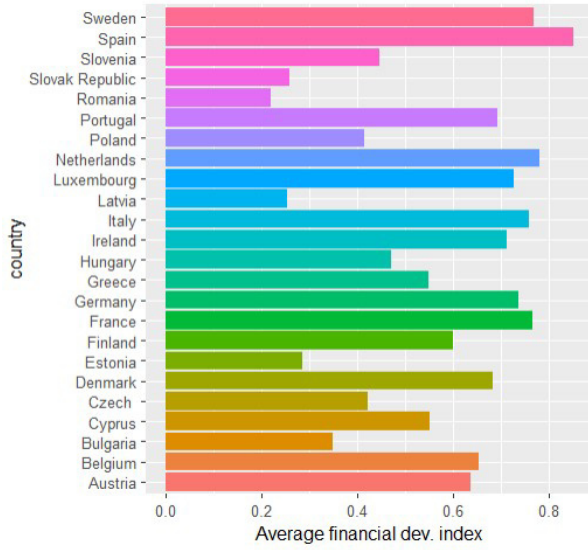


Figure 1: Bar plot of average FDI in EU.

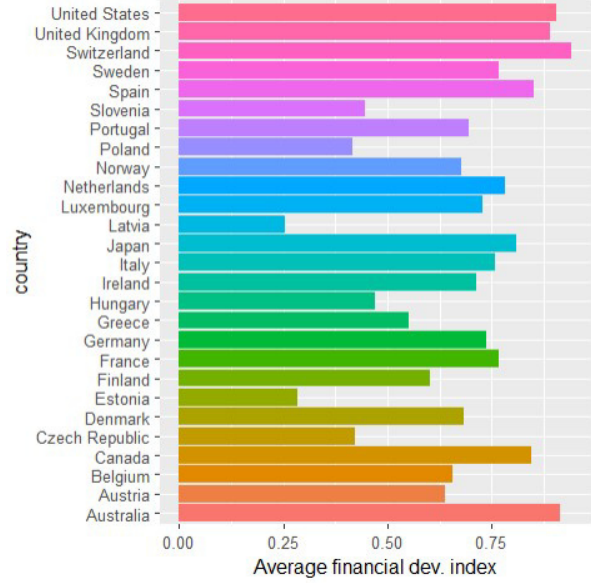


Figure 2: Bar plot of average FDI in OECD.

possibility of multicollinearity between the variables. Next, we apply our data set to the empirical strategy elaborated in section 3. Table 2 summarizes the results for a step by step estimation procedure for the EU economy selection ranging from the baseline scenario model 1 with simply the lagged debt ratio and the lagged output gap (column Mod I) to the more sophisticated model Mod VI including the controls and year dummies for the crisis. The upper part of the table refers to the low financial development regime (Regime I) while the lower part of the table shows the high financial development regime (Regime II). The threshold value - relevant for the transition or regime switch - and the number of the observations are given at the bottom of each column. Table 3 presents the OECD estimation outcomes in the same manner.

Table 2 shows that the regime shifts at about 60% of the financial development index in EU economies. While for all specifications (Mod I to Mod VI) of the low financial development regime (Regime I) the debt reaction indicates to be statistically significant and positive, thus sustainable, the business cycle behavior shows a significant negative sign, indicating pro-cyclical behavior. This seems to be robust among all specifications and added controls. Adding the Government expenditure gap shows the expected negative sign, additional spending negatively affects the primary balance. Interest rates seem to exert a negative influence on the primary surplus, inflation has a positive (disciplinary) effect on the primary budget in the low FDI regime while trade reduces the balance. Interestingly, once adding year dummies to study the effect of the financial and debt crisis the negative effect seems to become effective only 2009 onwards.

The picture changes once looking at the high financial development regime (Regime II, lower part). Again, debt indicates to be sustainable in the baseline scenario (Mod I) and adding public expenditures and interest rates or inflation (Mod II to Mod IV), however once trade and the crisis year dummies are included (Mod V and Mod VI) debt turns to become unsustainable. Also, the business cycle behavior switches to pro-cyclicality

Table 2: PSTR estimation - EU

	Mod I	Mod II	Mod III	Mod IV	Mod V	Mod VI
<b>Regime I - Low FDI</b>						
Lagged debt ratio	0.0083*** (0.0023)	0.0077*** (0.0000)	0.0099*** (0.000)	0.0159*** (0.0000)	0.0240*** (0.0000)	0.02071*** (0.0000)
lagged output gap	-0.3186*** (0.0948)	-0.2379*** (0.0000)	-0.2323*** (0.0000)	-0.1959*** (0.000)	-0.2117*** (0.0000)	-0.2918*** (0.000)
Govt exp gap		-0.4682*** (0.0000)	-0.490*** (0.0000)	-0.4528*** (0.0000)	-0.5015*** (0.000)	-0.4576*** (0.0000)
Interest rates			-0.0519*** (0.0000)		-0.01759*** (0.000)	-0.03144*** (0.0000)
Inflation				0.02799*** (0.0000)		
lagged trade					-0.0095*** (0.0000)	-0.0134*** (0.0000)
Year 2007						0.09858*** (0.0000)
Year 2008						0.2854*** (0.0000)
Year 2009						-0.00508*** (0.0000)
Year 2010						-0.5341*** (0.0000)
Year 2011						-0.4762*** (0.0000)
Year 2012						-0.0612*** (0.0000)
<b>Regime II - High FDI</b>						
Lagged debt ratio	0.01354*** (0.0004)	0.01294*** (0.0000)	0.0069*** (0.0000)	0.00061*** (0.0000)	-0.0141*** (0.0000)	-0.01431*** (0.0000)
lagged output gap	0.2216*** (0.0704)	0.2107*** (0.0000)	0.0788*** (0.0000)	-0.0428*** (0.000)	0.07661*** (0.000)	-0.0008*** (0.0000)
Govt exp gap		-0.1216*** (0.0000)	-0.1126*** (0.0000)	-0.1075*** (0.0000)	-0.1318*** (0.000)	-0.0966*** (0.0000)
Interest rates			0.2869*** (0.0000)		0.03111*** (0.000)	0.1531*** (0.0000)
Inflation				0.8550**** (0.0000)		
lagged trade					0.02245*** (0.0000)	0.01946*** (0.0000)
Year 2007						-0.2552*** (0.0000)
Year 2008						-0.4827*** (0.0000)
Year 2009						-0.5849*** (0.0000)
Year 2010						-0.9161**** (0.0000)
Year 2011						-0.3017**** (0.0000)
Year 2012						-0.01478**** (0.0000)
Threshold value(c)	0.65	0.67	0.66	0.68	0.62	0.60
Number of observations	480	480	480	480	480	480

Estimation of  $y_{it} = \mu_i + \beta_0 x_{it} + \beta_1 x_{it} g(q_{it}; \gamma, c) + u_{it}$  using PSTR. Where \*\*\* indicates statistical significance of at most 5% in the strict sense. Residuals are transformed via feasible GLS and hence is robust against serial correlation.

in Mod VI, while it had mainly been counter-cyclical in the other model specifications in that regime. The positive trade effect seems to be dependent on the regime: it is only visible in high financial development status. This could be related to the access and interrelations of the currency market and financial development status. Also, the trade variable seems to exert a negative pressure on the debt sustainability, as the negative coefficient turns positive once Mod VI is estimated without trade. It shows that particularly high financial development in the EU in crisis years had a severe influence on the debt behavior, reflecting the role of financial markets. Comparing the year dummies, it shows that the negative effect ranges from 2007 to 2012 for the high FDI regime, while the negative effect only starts in the low FDI regime in 2009. It seems that low financial development economies are not as exposed to the negative financial crisis effects as the high FDI countries.

Table 3 summarizes the OECD results and indicates a similar picture as compared to the EU situation in table 2. Again, in the low financial development regime (Regime I upper part of the table) all model specifications indicate debt sustainability and pro-cyclical behavior. Also government spending has the expected negative effect and inflation exerts a negative influence on the primary balance ratio. Interest rates and trade variable did not turn out to be significant. The crisis year dummies mainly reflect a negative significant effect, particularly 2007 and from 2010 to 2012. In the high financial development regime the picture changes and the results are rather mixed. Once significant, those debt coefficients indicate non-sustainability, while the output gap can have a counter-cyclical effect (Mod I) or a pro-cyclical effect (Mod VI). Interest rates and trade are not significant and inflation only in model specification V. The crisis year dummies show a significant negative effect, except 2008. However, these diverse results should be understood against the background that the OECD sample is much less homogeneous than the EU sample. Because of the heterogeneity the effects in the OECD are not as pronounced compared to the EU. Also, the threshold value, determining the affiliation to the low or high financial development regime tends to be higher and much more diverse in the OECD sample, ranging from 0.68 (Mod III) to 0.85 in Mod V. This also underlines the suggestion that the heterogeneity in this group is an important factor.

We visualize our residuals in order to detect the possibility of potential cross-sectional dependence (CSD). Similarities in the individual country residual plot indicate some degree of inter-country dependence. Figures 3 and 4 in the appendix depict the residual of the baseline model (mod I) for both EU and OECD respectively. All the residuals line plots are unique and heterogeneous (without similarities or dependence), pointing to the minimal chance of cross sectional correlation.

## 5 Concluding Remarks and Policy Implications

This paper investigated the role of financial development in the fiscal response function for 24 EU and 27 OECD countries for the time period 2000 to 2019 by distinguishing high and low financial development regimes with the panel smooth transition regression. Regarding the robustness of our results, we applied feasible GLS to

Table 3: PSTR estimation - OECD

	Mod I	Mod II	Mod III	Mod IV	Mod V	Mod VI
<b>Regime I - Low FDI</b>						
Lagged debt ratio	0.0013*** (0.0002)	0.0081*** (0.0039)	0.0111 (0.0238)	0.0090*** (0.0011)	0.0123*** (0.0078)	0.0072*** (0.0033)
lagged output gap	-0.3014*** (0.0006)	-0.3383*** (0.0035)	-0.2560 (0.1511)	-0.1894*** (0.0113)	-0.1952*** (0.0352)	-0.2290*** (0.0141)
Govt exp gap		-0.4066*** (0.0327)	-0.0506 (0.9828)	-0.6793*** (0.0545)	-0.6505*** (0.2104)	-0.6268*** (0.0268)
Interest rates			-0.2379 (0.1561)			
Inflation				-0.3893*** (0.0039)	-0.3212*** (0.0292)	-0.381*** (0.0375)
lagged trade					-0.0087 (0.0058)	
Year 2007						-0.4410*** (0.026)
Year 2008						-0.0825 (0.0519)
Year 2009						0.1291*** (0.0160)
Year 2010						-0.4104*** (0.0061)
Year 2011						-0.3826*** (0.0166)
Year 2012						-0.0202*** (0.0173)
<b>Regime II - High FDI</b>						
Lagged debt ratio	-0.0095*** (0.0010)	0.0032 (0.0075)	-0.0051 (0.0364)	-0.0168*** (0.0070)	-0.0371 (0.0274)	-0.0048 (0.0062)
lagged output gap	0.0610*** (0.0335)	0.0076 (0.2197)	-0.0168 (0.3966)	-0.0037 (0.0752)	0.0046 (0.2066)	-0.0815*** (0.0282)
Govt exp gap		-1.420 (0.793)	-1.529 (2.849)	-1.7150 (0.2938)	-1.939 (1.003)	-1.181*** (0.229)
Interest rates			-0.0779 (0.2862)			
Inflation				0.0027 (0.0750)	-0.1924*** (0.0157)	0.1585 (0.1288)
lagged trade					0.0150 (0.0189)	
Year 2007						-0.4906*** (0.0123)
Year 2008						0.7024*** (0.1241)
Year 2009						-0.3344*** (0.1077)
Year 2010						-0.7094*** (0.0746)
Year 2011						-0.6333*** (0.0592)
Year 2012						-0.3637*** (0.0937)
Threshold value(c)	0.71	0.69	0.68	0.81	0.85	0.64
Number of observations	540	500	460	500	500	500

Estimation of  $y_{it} = \mu_i + \lambda_t + \beta_0 x_{it} + \beta_1 x_{it} g(q_{it}; \gamma, c) + u_{it}$  using PSTR. Where \*\*\* indicates statistical significance of at most 5% in the strict sense. Residuals are transformed via feasible GLS and hence is robust against serial correlation.



transform our residuals in order to ensure our estimates are robust against serial correlation. Finally, we also show the absence of panel residual cross sectional dependence in our model. Based on that data driven selection mechanism we find a threshold of about 0.60 of financial development in the EU, for the OECD a little higher ranging from 0.68 to 0.85.

Our results for the EU show debt sustainability in both regimes and pro-cyclical behavior in the low financial development regime and counter-cyclical policy in high financial development. Once controlled for the financial crisis in the second regime the situation changes to unsustainable debt and pro-cyclical behavior. For the OECD group debt is only sustainable in the low financial regime and becomes unsustainable in the second regime. Again, the business cycle reaction changes from pro- to counter-cyclical behavior with the increase in financial development. Furthermore, controlling for the crises, high financial development induces unsustainable and pro-cyclical behavior. Because of the heterogeneity the effects in the OECD sample are not as pronounced as in the EU group.

In summary, our results indicate that financial markets fuel fiscal policy behavior. Too much financial development can influence particularly the debt reaction and the business cycle. In regimes of high FD, the government has greater access to financial markets and has a high tendency to borrow from the financial market, financing government debt is therefore relatively easier. Hence, we observed a weaker response of the primary balance to changes in debt to GDP ratio. Moreover, a negative shock to the financial market (financial crises) renders fiscal policy unsustainable in a high FD regime due to the apparent over-reliance of fiscal policy on the financial markets. Our result supports this assertion. However, it is not the case in a low FD regime where we observed a relatively stronger fiscal response and sustainable behaviour once we control for the financial crisis. The intuition is that, due to the relatively low level of financial market development, fiscal policy (deficit financing) is not too dependent on the financial market. Hence a negative financial shock could have less impact on debt sustainability in a low FD regime.

Regarding policy implications these results imply that high financial development does not automatically mean "better" fiscal policy stance. Very high financial development and financial market involvement can fuel unsustainable fiscal behavior especially when there is over-reliance of fiscal authorities on financial markets for debt/deficit financing. Such economies are likely to be susceptible to unsustainable fiscal stance during periods of financial shocks. Based on our results, we propose the following policy recommendations. Policymakers should minimize over-reliance on the financial market for the debt/deficit financing decisions. Rather, policy financing via financial markets should be complemented with the pursuance of fiscal consolidation measures (increasing revenue or reduction in spending or a combination of both) to ensure that the economy is not pushed to an unsustainable path during crises period or by financial shocks.

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# Appendix

Table 4: Country-level summary statistics for fin. dev. index  
- OECD

Country	min	max	mean	median	sd	p25	p75
Australia	0.86	0.97	0.92	0.92	0.03	0.90	0.93
Austria	0.57	0.74	0.64	0.62	0.05	0.61	0.66
Belgium	0.59	0.73	0.66	0.66	0.04	0.64	0.68
Canada	0.70	0.92	0.85	0.88	0.07	0.77	0.90
Czech Republic	0.31	0.47	0.42	0.44	0.05	0.40	0.46
Denmark	0.60	0.73	0.68	0.68	0.04	0.67	0.71
Estonia	0.23	0.33	0.29	0.28	0.03	0.27	0.31
Finland	0.52	0.67	0.60	0.61	0.05	0.55	0.64
France	0.69	0.83	0.77	0.78	0.05	0.72	0.81
Germany	0.70	0.78	0.74	0.74	0.02	0.72	0.75
Greece	0.46	0.67	0.55	0.53	0.06	0.49	0.61
Hungary	0.40	0.57	0.47	0.44	0.06	0.43	0.53
Ireland	0.66	0.79	0.71	0.71	0.04	0.67	0.74
Italy	0.73	0.80	0.76	0.76	0.02	0.74	0.77
Japan	0.69	0.90	0.81	0.81	0.06	0.79	0.84
Latvia	0.17	0.31	0.25	0.25	0.04	0.24	0.29
Luxembourg	0.71	0.75	0.73	0.73	0.01	0.72	0.74
Netherlands	0.68	0.86	0.78	0.79	0.05	0.73	0.83
Norway	0.56	0.78	0.68	0.67	0.06	0.65	0.72
Poland	0.27	0.47	0.41	0.44	0.06	0.38	0.45
Portugal	0.64	0.80	0.69	0.69	0.04	0.67	0.72
Slovenia	0.35	0.55	0.45	0.46	0.07	0.38	0.50
Spain	0.81	0.90	0.85	0.84	0.03	0.83	0.88
Sweden	0.69	0.81	0.77	0.78	0.04	0.74	0.80
Switzerland	0.79	1.00	0.94	0.96	0.06	0.95	0.98
United Kingdom	0.84	0.95	0.89	0.90	0.03	0.87	0.90
United States	0.87	0.92	0.90	0.91	0.01	0.90	0.91

Table 5: Correlation matrix - EU data

Variables	Pbratio	Lagged debt	lagged output	Exp gap	Fin dev	Infl	Int. rates	lagged trade
Pbratio	1							
Lagged debt	0.214	1						
Lagged output	-0.248	-0.380	1					
Exp gap	-0.383	-0.057	0.048	1				
Fin dev	0.195	0.390	-0.006	0.001	1			
Infl	-0.092	-0.265	0.254	-0.047	-0.295	1		
Int rates	-0.104	-0.271	0.163	0.000	-0.341	0.327	1	
Lagged trade	0.012	0.092	0.049	0.017	0.247	-0.192	-0.482	1

Table 6: Correlation matrix - OECD data

Variables	Pbratio	Lagged debt	lagged output	Exp gap	Fin dev	Infl	Int. rates	lagged trade
Pbratio	1							
Lagged debt	0.107	1						
Lagged output	-0.167	-0.346	1					
Exp gap	-0.375	0.017	-0.139	1				
Fin dev	0.052	0.272	-0.056	-0.008	1			
Infl	-0.179	-0.298	0.497	-0.253	-0.241	1		
Int rates	-0.122	-0.354	0.441	-0.151	-0.161	0.581	1	
Lagged trade	0.006	0.003	0.047	0.014	0.118	-0.061	-0.115	1

Figure 3: Country-wise residual plot: EU

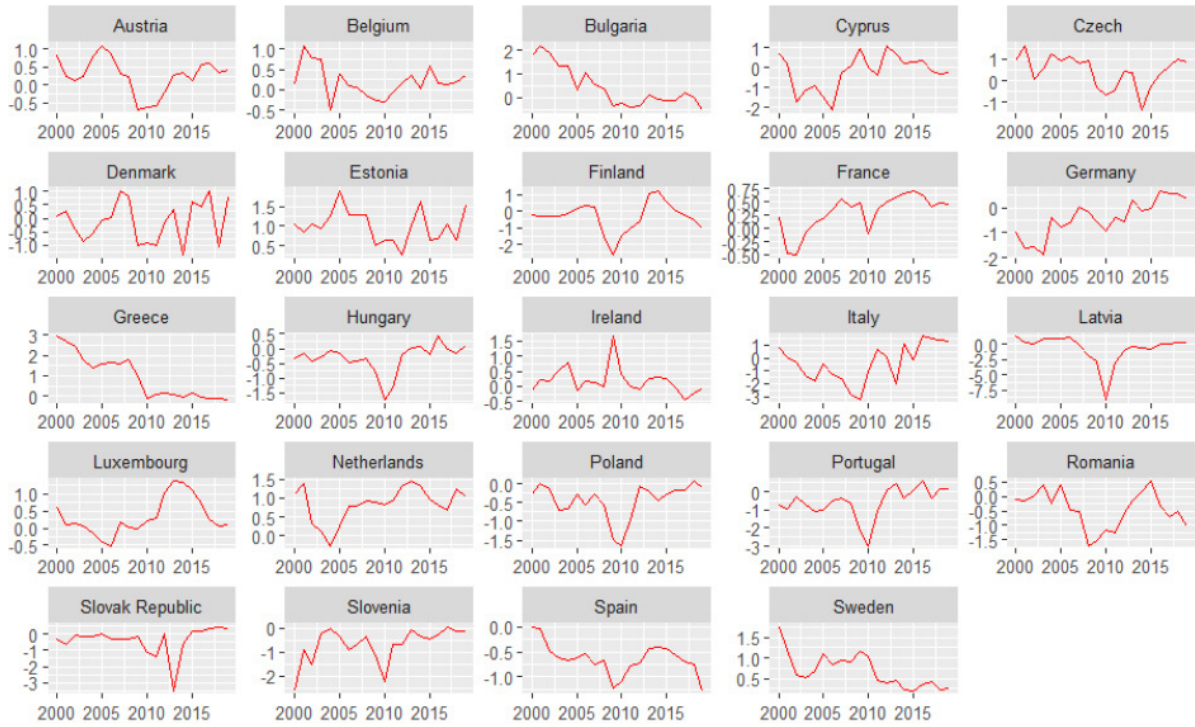


Figure 4: Country-wise residual plot: OECD

