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Non-Linearities in Fiscal Policy: The Role of Debt

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Non-Linearities in Fiscal Policy: The Role of Debt*

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Abstract

Empirical evidence shows that fiscal multipliers depend on the state of the cycle, the nature of fiscal policy and the level of debt. In other words, evidence points to non-linearities in the effects of fiscal policy. This paper provides a framework to examine the role of the level of government debt in the assessment of consolidation policies across the business cycle, allowing for the consolidation multiplier to depend on the level of debt at the time of consolidation. The empirical analysis, which uses a panel of 13 countries between 1980 and 2014, finds that when debt is high, fiscal consolidations based on tax increases are in general self-defeating, in that they result in an increase of the debt-to-GDP ratio. Instead, cutting public expenditure has a less pronounced effect on economic activity and can stabilize debt. The initial level of debt in an economy, when a fiscal consolidation is implemented, appears to work as a channel in explaining evidence of state-dependence of the different consolidation instruments.

JEL Classification Numbers: C33, E62, H60, H63

Keywords: Debt, Recessions, Expansions, Fiscal consolidations, Interacted-STVAR

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Contents

1 Introduction

The Global Financial Crisis and the Great Recession have triggered a renewed interest in the effects of fiscal policy. At the same time, discussions have increased regarding countries with high public debt under fiscal austerity programs. One of the main topics of policy debates relates to the implications that these fiscal austerity measures have for the macroeconomy, especially when a country is in an economic downturn and is experiencing a high level of debt. This paper assesses the role of the level of *public debt* in determining the size of state-dependent fiscal multipliers and the extent that fiscal consolidations are able to stabilise, decrease, or not the debt-level of a country.

Until recently, most of the literature estimated a single fiscal multiplier without taking into account the state of the economy. Recent work (e.g. Auerbach and Gorodnichenko (2012, 2013), Ramey and Zubairy (2018)) investigates whether estimates of fiscal multipliers differ depending on the state of the business cycle. Regarding the theoretical literature there are several theoretical studies that link the size of the multiplier to economic downturns. Some examples include Michaillat (2014) on the labor market, Canzoneri, Collard, Dellas and Diba (2016), who make use of a costly financial intermediation as a financial friction and show that fiscal multipliers are state-dependent, Sims and Wolff (2018a, 2018b) who look into state-dependent effects of tax and government spending shocks within a medium-scale DSGE model, and Fotiou, Shen and Yang (2020) who use a DSGE model with regime-switching fiscal policy. Some other New Keynesian models, such as Christiano, Eichenbaum, and Rebelo (2011) and Woodford (2010), highlight the importance of the phase of the business cycle and study the multiplier effect when the economy is near the zero lower bound.

Alesina, Azzalini, Favero, Giavazzi and Miano (2017) shift the focus from the state of the cycle, arguing that it is not simply "when" a fiscal adjustment happens that matters (i.e. recessions versus expansions), but also "how" it happens (i.e. expenditure-based versus tax-based). Differently, in my paper, the aim is to understand whether the heterogeneity in the responses of different policy instruments in different times is driven by the initial condition of the economy and assess the effectiveness of these policies. In that, I allow for the consolidation multiplier to depend on the level of debt at the time of consolidation. Often a fiscal consolidation is implemented from governments when debt is high, as a strategy to stabilize it or reduce it. But if the level of debt is high and investors do not consider it no longer sustainable, a consolidation plan may have different effects independently if the

economy is going through an economic upturn or downturn. Accounting for heterogeneous effects is critical, since the size of the multiplier can be more relevant in circumstances of economic downturns, even more so when a country has a high level of debt.

During the crisis that affected southern European countries, the level of debt was central for the impact of fiscal consolidations. Consolidation-related announcements can lead to higher borrowing rates and thus contribute to a further increase in deficits and debt. The level of government debt in a country is also relevant when the fiscal authority decides to implement a new fiscal consolidation, since a different position at the Laffer curve could have different implications in the transmission of fiscal policy. The main goal of this paper is to account for the initial condition of the economy — namely, the level of debt — in assessing the transmission and effectiveness of fiscal consolidation policies in different times and contribute to the ongoing debate about the time-varying effects of fiscal shocks on the macroeconomy. Therefore, I propose a general model that provides enough flexibility to account for different non-linearities. In this paper, I focus on three non-linearities. The first arises from the state-of the economy, i.e. *recessions versus expansions*. The second is the composition of the fiscal consolidation, i.e. *tax-based versus expenditure-based*.[1] The third and novel non-linearity in the state-dependent literature arises from the government's budget constraint, i.e. *high-debt ratio versus low-debt ratio*, allowing for the consolidation instrument to depend on the country's debt level when implemented.

The recent literature on state-dependent multipliers (e.g. Auerbach and Gorodnichenko (2012) (AG in what follows)) uses the smooth transition vector autoregression (STVAR) model.[2] This is a regime-switching model, based on a logistic distribution that controls for the transition from one regime to the other, with weights computed as a moving average of GDP growth. Nickel and Tudyka (2014) estimate fiscal multipliers taking into account countries' fiscal positions. They augment a panel vector autoregression model and introduce debt through an interaction term, the interacted panel vector autoregression (IPVAR). I propose a blend of these two models (STVAR and IPVAR), the interacted smooth transition vector autoregression (ISTVAR) model. This model is a flexible way to condition endogenously on countries' government debt and examine the relevance of the instrument of stabilization that the government uses, taking into account the state of the economy. Differently from

[1] A fiscal consolidation is a mix of tax and government spending changes. Tax-based (expenditure-based) means that the total of adjustments is mainly based on tax increases (spending cuts).

[2] In AG (2012) the identification of exogenous shifts in fiscal variables is obtained using the Blanchard-Perotti identification assumptions. This paper uses a narrative identification approach.

Nickel and Tudyka (2014), I endogenously track the dynamics of debt by explicitly modelling the evolution of the government debt-to-GDP as a function of the interest rate payments on the debt and the primary government deficit (Favero and Giavazzi (2012)). Therefore, I contribute to the state-dependent literature of fiscal policy not only by looking into the stabilization instrument that the fiscal authority uses to reduce the level of debt, but by including and conditioning on debt itself. I add to the state-dependent fiscal policy literature and focus on the effect that the initial debt condition of a country may have in the propagation of a fiscal consolidation policy.

When debt is high, I find that expenditure-based consolidations are more effective in stabilizing the debt-to-GDP ratio. On the one hand, tax-based consolidations appear to be self-defeating. Instead of reducing the deficit, they deliver on average higher debt ratios because the negative effect on GDP growth is larger from the budget changes. On the other hand, expenditure cuts are able to stabilize debt independently of the state of the cycle. I find evidence of state-dependency and the level of debt appears to work as a channel to explain the results that have previously documented in the literature (e.g. Guajardo, Leigh and Pescatori (2014), Alesina, Favero, and Giavazzi (2015)). In that, the heterogeneity in the contraction of the different consolidation instruments documented in the literature appears to be driven by periods of low-debt.

Is it the "*how*" — the way the stabilization is performed? Is it the *"when"* — the phase of the cycle? Or is it the *"initial condition"* of the economy — namely, debt — that plays the most pivotal role and potentially constrains fiscal policy under all the different dimensions? Devries, Guajardo, Leigh, and Pescatori (2011) constructed an important narrative panel dataset of tax and spending changes that was then extended by Alesina, Favero and Giavazzi (2015). Guajardo, Leigh, and Pescatori (2014) study the effects of these unanticipated narratively identified shocks on macroeconomic variables and find that that tax-based consolidations are more contractionary than spending-based ones. Alesina, Favero and Giavazzi (2015) in the extended dataset, distinguish between the impact of impact of unanticipated and anticipated fiscal changes on the macroeconomy and reach the same conclusion. Both papers examined the "*how*". Alesina, Azzalini, Favero, Giavazzi and Miano (2017) look into both the "*how*" and the *"when"* and using the same dataset, and in a baseline specification in which they account for the state of the cycle, find little evidence of state-dependency and conclude that spending-based adjustments are always much less costly compared to tax-increases.

In my paper, I include a third dimension and turn the focus on the *"initial condition"* of debt when a consolidation policy is implemented. This allows me to assess the effectiveness of the different consolidation instruments in stabilising or reducing the debt-to-GDP ratio. I study initial conditions of high and low debt as well as the potential of heterogeneous effects of tax- and expenditure-based fiscal consolidations implemented in bad and good times. Compared to the existing literature, I find evidence of state-dependency. My results indicate that the debt level works as a channel to explain the heterogeneous implications of fiscal adjustments at different stages of the business cycle.

Existing empirical evidence (e.g. Favero and Giavazzi (2012)) shows that omitting debt can bias the evaluation of the output effects of fiscal policy. In my context, when the state of public finances is weak, this triggers a fiscal consolidation. This consolidation episode improves the primary balance of the government, but it also has a negative effect on the output growth. In addition, in future periods, this adjustment may constrain the future path of taxes and spending, since the government's budget constraint should eventually be respected. Including debt allows me to account precisely for these different channels and observe whether the fiscal authority succeeds in meeting its objective (i.e. to shore up fiscal sustainability) depending upon the initial condition of debt, the instrument of stabilization, and the state of the economy. Several studies (e.g. Ilzetzki, Mendoza and Vegh (2013), Corsetti, Meier and Müller (2013)) have highlighted the importance of the state of public finances of a country.

The size of the fiscal multiplier has been broadly studied in the literature. Answers vary and depend, to some extent, on the methodology, the nature of the shock, the identification scheme and the data. Ramey (2019) through a thorough survey of the literature and discusses how the different methodologies and identification approaches — i.e., the structural identification approach (e.g. Blanchard and Perotti (2002), Mountford and Uhlig (2009)) and the narrative approach (e.g. Ramey and Shapiro (1998), Romer and Romer (2010)) — may result in different multiplier estimates.

The paper is structured as follows: In the next section of the paper, I present a general model which indicates what follows. Section 3 presents the data and discusses the three types of non-linearities. The proposed model specification is introduced in Section 4. The results are included in Section 5. Section 6 concludes.

2 The General Model

My goal in this paper is to provide a general encompassing framework to simultaneously assess the relevance of different sources of non-linearities. To study non-linearities in the effects of fiscal policy I need a dynamic model which can account for:

1. The behavior of the macroeconomic variables of interest (Y_t) and
2. the behavior of the policy variables under study (P_t).

The macroeconomic variables (e.g. real gdp growth, consumption, etc.) are typically assumed to be a function of both their own past values, the past values of the policy variables and any exogenous adjustments or deviations of the fiscal authority from its rule. These functions can potentially be non-linear and depend on different economic conditions.

At the same time, the policy variables respond to the change of the fiscal authority rule, as well as through a potential feedback effect from the past policy decisions together with the effect arising from the response of the macroeconomic variables. A general framework that can describe the joint evolution of the two sets of variables is:

$$Y_t = f_1\left(Y_{t-1}, P_{t-1}, shock_t; \Phi_1\right) + u_{1t} \tag{1}$$

$$P_t = f_2\left(Y_{t-1}, P_{t-1}, shock_t; \Phi_2\right) + u_{2t}.$$

The vector Y_t represents the vector of macroeconomics variables for $t = 1, 2, ..., T$ years, whereas P_t represents the set of policy variables. This, for example, can be a fiscal policy rule as a reaction function to a monetary policy shock. In my study the policy rule is the debt-to-gdp ratio. Φ_j, with $j = 1, 2$, are the parameters that we need to estimate. The functions f_j need to be defined according to the question under study, to account for either linear or non-linear responses. The choice of the functions clearly depends on the question of interest. At the same time, it depends on the policy rule and the number of macroeconomic variables included in the system (and vice-versa). The reason is that the scarcity of the data, especially when one uses a narrative record of identified shocks, puts some limits in the degrees of freedom and the number of parameters that can be estimated.

Once all the necessary components of the model are specified, one can proceed with the estimation of the model (e.g. via seemingly unrelated regression equations or maximum

likelihood) and the derivation of impulse response functions. The derivation of the impulse response functions can be done through the generalized impulse response function, which I discuss in Section 5. The last step, concerns the calculation of fiscal multipliers as the ratio of the integral of the output response to the integral of the policy adjustment.

The above general encompassing model sets the base for the analysis that follows.

3 Data and Non-Linearities

3.1 Data

I make use of the narrative record initially constructed by Devries, Guajardo, Leigh, and Pescatori (2011) and extended by Alesina, Favero and Giavazzi (2015). The dataset consists of a time series of fiscal consolidations of 17 OECD countries. The countries included in the initial data are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Portugal, Spain, Sweden, United Kingdom, United States, for the period 1980 to 2014. Motivated by the literature of the narrative identification approach of Ramey and Shapiro (1998) and Romer and Romer (2010), Alesina, Favero and Giavazzi (2015) examine historical records available in official documents (Budget Reports, Budget Speeches, Central Banks Reports, Convergence and Stability Programs submitted by EU governments to European Commission, IMF Reports, OECD economic surveys) to identify the size, timing and principal motivation behind any fiscal action taken by each government. The fiscal alterations are measured as a percentage of GDP. As in Devries, Guajardo, Leigh, and Pescatori (2011), the focus is restricted to the identification of fiscal changes that are exogenous to the economic cycle, as well as changes that are motivated by the willingness to reduce government deficit. This implies that a fiscal consolidation with the goal of restraining domestic demand or any other countercyclical policy is not included in the dataset. Figure 1 shows the aggregate narratively identified unanticipated and anticipated episodes for each country.

The classification of fiscal consolidations as tax-based (TB) or expenditure-based (EB) is based on the spirit of the work of Alesina, Favero and Giavazzi (2015) as it will be further discussed in the next section. A fiscal consolidation is a mix of tax and government

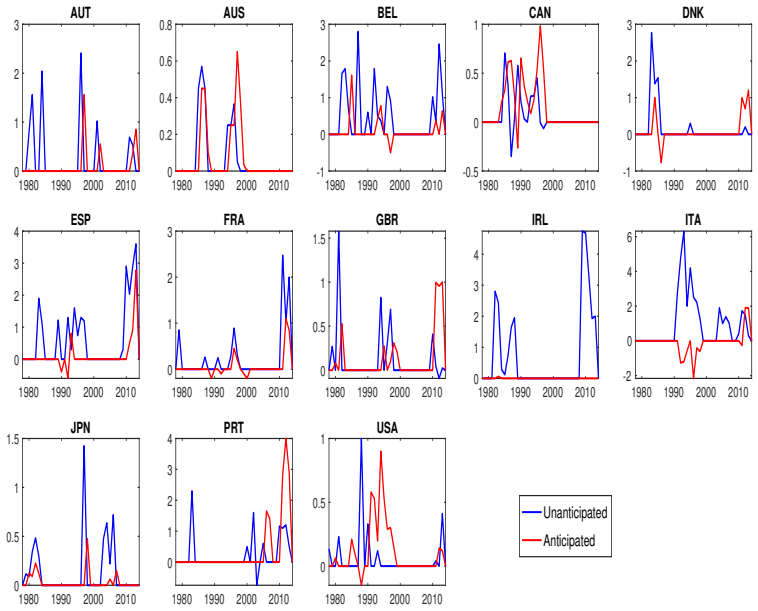

Figure 1: Country-specific narrative unanticipated (blue) and anticipated (red) fiscal adjustments. Sample coverage (x-axis), Size of the fiscal adjustments (y-axis).

spending changes, where tax-based (expenditure-based) means that the total of adjustments is mainly based on tax increases (spending cuts). The difference from Alesina, Favero and Giavazzi (2015) is that I do not include all the paths of future announcements of fiscal adjustments. I consider just the unanticipated and anticipated legislative announcements that are implemented the same year.[3,4] Figure 2 depicts the EB and TB fiscal narratively identified shocks together with the GDP growth. The initial sample consists of 17 countries, but after performing some exogeneity tests I drop three countries: Finland, Netherlands and Sweden. In addition, I drop Germany because data are available after 1991, due to unification, and this restricts my analysis. My final sample includes a total of 74 episodes for taxes and 101 episodes for government spending. The main macroeconomic variables of interest in my baseline specification are real GDP growth, the change of log real government spending as a fraction of GDP, which is primary government spending (total government spending net of interest payments on debt), the change of log real government revenues (current receipts) as a fraction of GDP, the average cost of debt and inflation.[5] The frequency of observations is annual. My primary data source is the OECD.

[3]The challenge of the narrative data is that there is often a lack of information. Governments do not make legislative announcements on a frequent basis. This means that if ones takes the time series of announcements of a country, there is limited information, since there are many years that no announcement took place, hence there are many zeros in the data (see Figure 4). This phenomenon is even stronger when one accounts for the future implementation of fiscal changes, since in this case we would need to add an additional variable/ time series that it is going to include even less information affecting the degrees of freedom and the precision of the estimates. The exclusion of the future announcements does not create any bias, since in general most of the plans of announcements have a one year horizon (on average TB plans last around 1.5 years, and EB plans 1.8 years), which is the information that I include in my sample.

[4]This is in line with the work of Devries, Guajardo, Leigh, and Pescatori (2011).

[5]More precisely, government spending includes government final consumption, government investment, social security benefits and other current outlays.

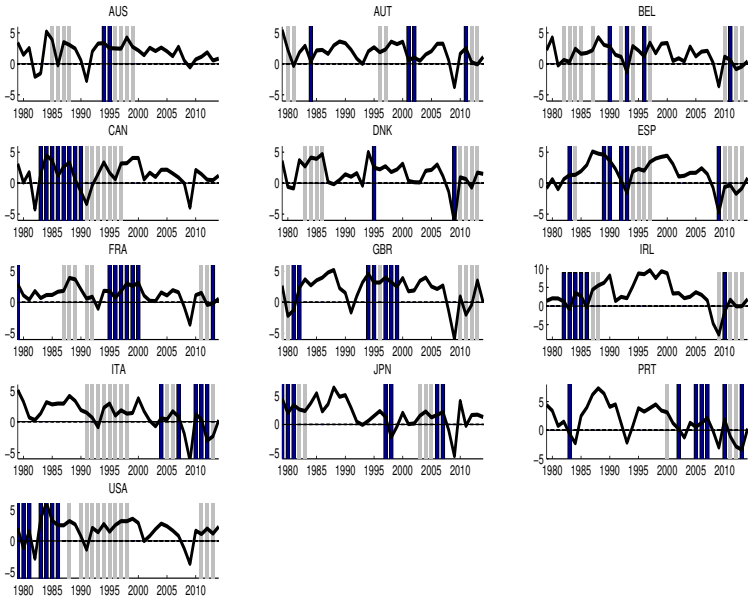

Figure 2: EB (blue) and TB (grey) episodes and the per capita GDP growth series (black line).

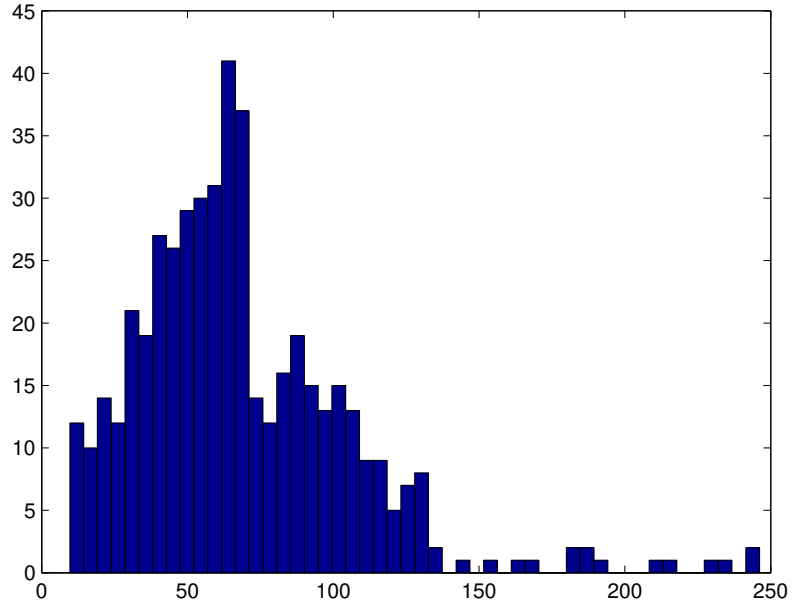

Figure 3: The distribution of fiscal position during the period 1980-2014. Debt-to-GDP ratio (x-axis), Frequency in % (y-axis).

In my general model, public debt plays the role of the main policy variable. In the next subsection, I present the construction of this series. I use the general government debt as a percent of GDP from the WEO of the IMF as a reference series. The histogram of Figure 3 shows the distribution of the government debt data of my sample. In my analysis, those data serve as the initial values of the implicit debt-to-GDP ratio. In Figure 4 I also plot the distribution of TB and EB fiscal consolidations that have been announced by country authorities with the aim to stabilize the debt-to-GDP ratio.

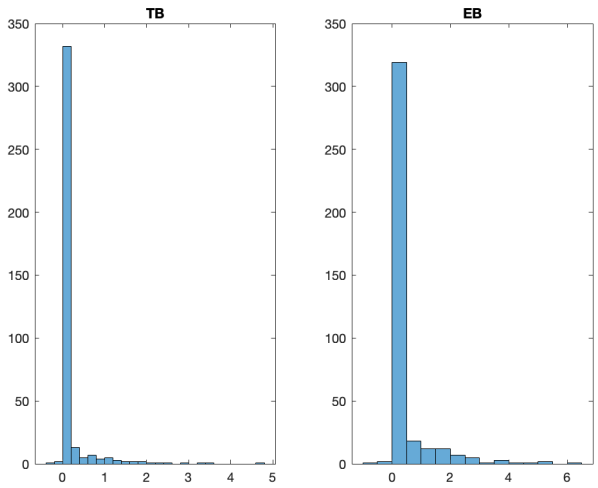

Figure 4: The distribution of TB and EB fiscal consolidations during the period 1980-2014. Fiscal consolidations (x-axis), Frequency in % (y-axis).

3.2 Non-Linearities

3.2.1 State of the Economy

The first asymmetry of interest in my study arises from the state of the economy, namely if an economy is in recession or expansion. I follow Auerbach and Gorodnichenko (2012, 2013) and I use a regime indicator that is based on a logistic function, which I denote as $F(z_{it})$. $F(z_{it})$ indicates the probability of being in a recessionary regime. This is the key ingredient which allows me to smoothly endogenize in my model the possibility of the economy to move from one state to another and at the same time to track the feedback (as Caggiano, Castelnuovo, Colombo and Nodari (2015)) after a fiscal adjustment.

In my baseline specification the logistic function is a function of the two-years moving average of GDP growth and takes the following form

$$F(z_{it}) = \frac{\exp[-\gamma_i z_{it}]}{1+\exp[-\gamma_i z_{it}]}, \ \gamma_i > 0. \tag{2}$$

I denote by s the growth rate of output, as a moving average of two years, i.e. $s_{it} = \frac{\Delta y_{it-1}+\Delta y_{it-2}}{2}$, where Δy_{it} is GDP growth for country $i = 1, .., 13$ at time $t = 1, \ldots, 35$. I use as an index of the business cycle the standardized measure (i.e. the z-score) of s_{it}, which is $z_{it} = \frac{s_{it}-E(s_{it})}{\sigma(s_{it})}$.

γ_i is the parameter that controls the smoothness of the transitions from one regime to another for each country. In general, large values are associated with immediate switches, while smaller ones imply a smoother transition. γ_i is calibrated in a way that matches the frequency and duration of recessions in an economy. The economy spends an $x\%$ of time in a recessionary regime according to the OECD dates. My goal is to calibrate γ_i to match this frequency. For example, for the US $\Pr((z_{it}) > 0.8 = 0.2)$, where I define an economy to be in a recession if $F(z_{it}) > 0.8$. Thus, this implies that I need to set $\gamma_i = 1.5$. Therefore, the magnitude of γ_i is in line with estimates of logit regressions of the OECD recession dates on the measure of z for all the countries in my sample.

The OECD dates are available from the Federal Reserve Bank of Saint Louis. These dates are based on the OECD Composite Leading Indicator (CLI). The series of the CLI is based on the growth cycle approach, where business cycles and turning points are identified through a deviation from the trend method. The recession dates are available in quarterly data, are not seasonally adjusted and are recorded as a dummy variable (1: for recession, 0: for expansion). I have yearly data on the narratively identified shocks, hence I translate the quarterly recession series of each country into a yearly recession series.[6]

The general rule that I follow to calibrate γ_i for each country is that $\Pr((z_{it}) > 0.8 = x_i)$. Figure 5 shows the comparison of the constructed transition series based on the calibration of an economy being in an extreme recession to the recession dates associated to the economic downturns of the 13 economies of the sample. The country-specific *gammas* are presented in Table 1. On average, the duration that an average economy spends in a recessionary regime is 18% of its time.

[6]I base the calibration of each country in years of extreme recessions, i.e. in years that all quarters where recorded as recessionary. However, since there are years that could be classified either as recessionary or expansionary because half of the quarters are recorded as being in recession, I use a random algorithm to also record some of these years and account for possible weak recessions. The shaded grey bars reported in Figure 5 include years both of extreme and weak recessions, in order to better understand the transition series.

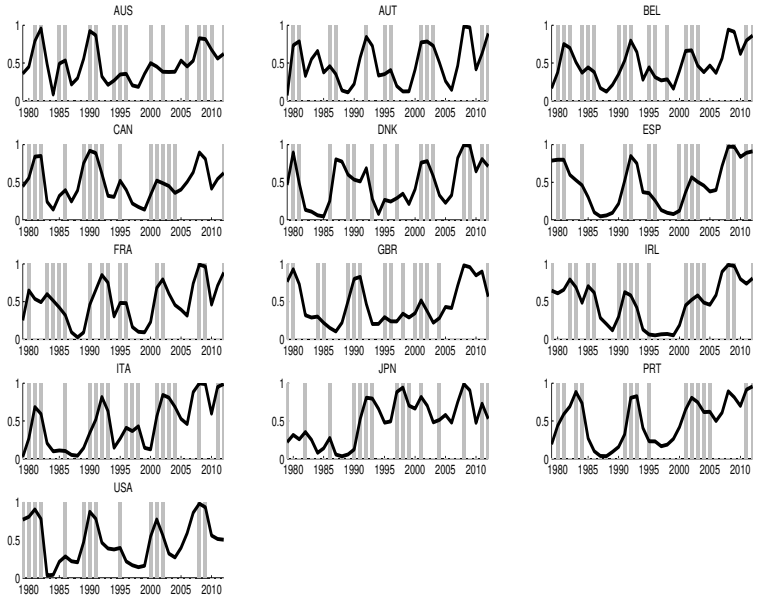

Figure 5: Recession dates (shaded grey area) and the weight F(z) on the recession regime (black line).

Table 1: Calibration of smoothness parameter γ

Country	Duration of Recessions	γ	Country	Duration of Recessions	γ
AUS	14%	1.14	**GBR**	19%	1.43
AUT	14%	1.53	**IRL**	14%	1.68
BEL	14%	1.13	**ITA**	22%	2.24
CAN	17%	1.09	**JPN**	17%	1.65
DNK	19%	1.72	**PRT**	22%	1.60
ESP	25%	1.70	**USA**	17%	1.56
FRA	14%	1.59			

3.2.2 Type of Fiscal Consolidation

The second asymmetry reflects the possible importance of the composition of the fiscal adjustment. Views about the relative effect of taxes or government spending differ among public debates and policymakers. Devries, Guajardo, Leigh, and Pescatori (2011) in their narrative record identify fiscal policy changes that are based either on taxes or government spending. Instead of directly including in my specification the tax and government spending adjustments, I follow Alesina, Favero and Giavazzi (2015) and take into account the fact that the different nature of changes may be correlated. In this way, I consider the entire fiscal adjustment that the fiscal authority implements, that consists of tax changes and government spending changes together. Then, I classify an adjustment as being tax-based (expenditure-based), if it is mainly based on tax increases (spending cuts), namely if the sum of the unanticipated and anticipated components of the tax changes (spending changes) is greater than the respective sum of the unanticipated and anticipated components of the government spending changes (tax changes).

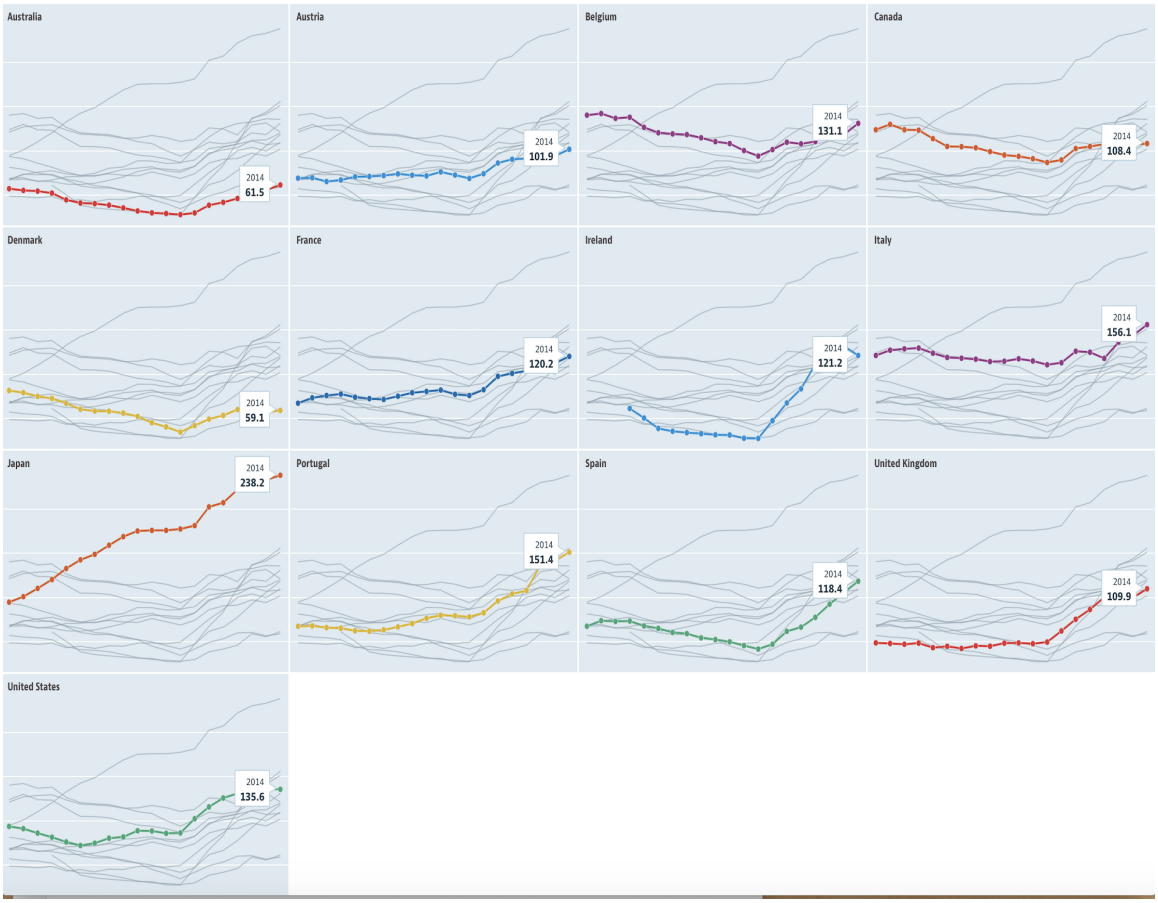

Figure 6: Debt-to-GDP ratio (Figure from the OECD website).

3.2.3 Government Debt

Figure 6 is taken from the OECD website and shows the government debt as a percent of GDP series of the different OECD countries for 1995-2014. In each subplot, there is a highlighted country with a background of the rest of the OECD countries as a comparison. From this figure it is possible to observe that countries like Belgium, Italy and Japan belong always in the group of countries with higher government debt. On the other hand, Portugal and the United States, for example, are cases that switch from being higher to lower (or vice versa). This means that it is not possible to fix ex-ante the countries that would be classified as belonging in a group of "higher-" or "lower-" debt countries. The Interacted Smooth Transition VAR (ISTVAR), which is presented in Section 5.1, is a flexible way to endogenously model debt, without grouping countries into a higher or lower debt category.

I adopt the idea of Favero and Giavazzi (2012) to model debt in a way that mimics the government's budget constraint.

$$Debt_{it} = \frac{1 + i_{it}}{(1 + \pi_{it})(1 + \Delta y_{it})} Debt_{it-1} + (\exp(g_{it}) - \exp(\tau_{it})). \tag{3}$$

i stands for the average cost of government debt, π is the inflation rate, g is primary government spending as a fraction of GDP and τ is government revenues, also as a fraction of GDP .[7,8] The debt-to-GDP ratio is, in this way, determined by the macroeconomic variables that are included in my specification. Figure 7 shows evidence that with the above equation (3) I manage to track well the debt-to-GDP ratio observed in the data. Differences may be due to the presence of seigniorage, which is not considered in my framework, the possible existence of stock-flow adjustments that lead to some measurement error, or due to approximation errors, since I use logarithms for the GDP growth rate and the inflation rate. For Australia, the fact that I combine different data sources to construct the series due to limited availability of data, may also explain why the implicit series does not match the observed series of the debt ratio. Often countries experience stock-flow adjustments due to financial asset accumulations, which is common among countries that were experiencing budget surpluses on average and had relatively lower debt levels, such as Denmark (see Weber, 2012).

To understand better the insights of this identity I split (3) into two components: *a.* the so-called *snowball effect* ($\frac{1+i_{it}}{(1+\pi_{it})(1+\Delta y_{it})} Debt_{it-1}$) and *b.* the *primary balance effect*. Those represent the two channels that affect the evolution of debt following a consolidation episode. For example, suppose that the government reduces its expenditure by 1% of GDP. This implies a negative output effect and a decrease in government spending. In terms of *a.*, the decrease of output growth, for a given past value of debt and a given i, implies an increase on the debt-ratio. However, in terms of *b.*, the expenditure reduction has a direct impact on the primary balance, which improves, and reduces the debt-ratio.[9] Therefore, debt will increase or decrease depending on the synergy that eventually dominates.

[7]With a small abuse of notation, i denotes both the interest rate and indexes the country under consideration. Nevertheless, no confusion should arise given that country-indexes always occur as subscripts.

[8]I take the exponential of government spending (as a fraction to GDP) and government revenues (as a fraction to GDP), because these variables are in logarithms.

[9]The effect on output has a further indirect effect on the primary balance, which arises from the automatic stabilizers. In addition, there is potentially a third channel through the interest rate payments. In my discussion, I will focus on the main effects of *a.* and *b.*

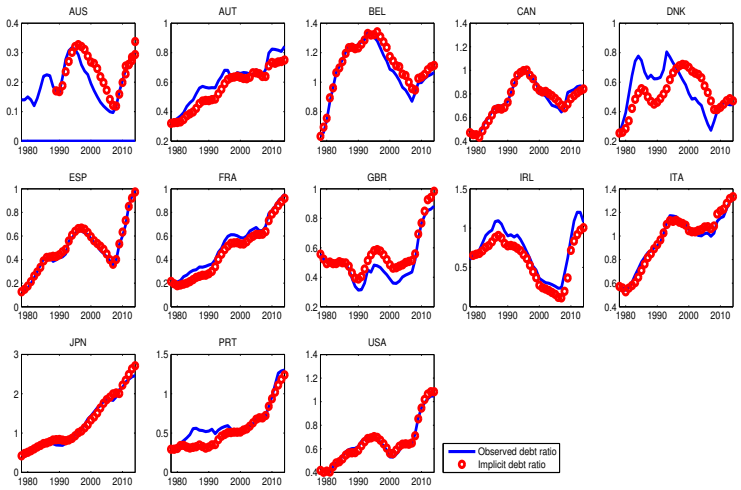

Figure 7: Observed Debt-to-GDP (data) versus the simulated series.

4 Model Specification

4.1 An Interacted Smooth Transition VAR

The novelty of this paper relies on the study of the role of public debt in the transmission of consolidation-type of shocks. To illustrate this, I adopt the general model that I presented in Section 3, where I introduce the asymmetries of interest (i.e. state of the economy, type of fiscal consolidation, government debt). To make model (1) functional I need to specify the different sets of variables and functional forms. My underlying assumption is that the fiscal shocks depend on the level of debt, given the fiscal authority's aim to shore up fiscal sustainability using the different consolidation instruments. In that, I explicitly interact the government budget constraint (3) with the identified consolidations. I employ a model which I call Interacted Smooth Transition Vector Autoregression (ISTVAR), which reads as follows:

$$Y_{it} = (1 - F(z_{it})) \times \left[A_E Y_{it-1} + \Theta_E Debt_{it-1} + B_{1E} e_{it}^{EB} + B_{2E} e_{it}^{TB}\right] + \\ + F(z_{it}) \times \left[A_R Y_{it-1} + \Theta_R Debt_{it-1} + B_{1R} e_{it}^{EB} + B_{2R} e_{it}^{TB}\right] + \\ + \lambda_i + \chi_t + u_{it} \quad (4)$$

$$B_{jS} = B_0^S + B_1^S \cdot Debt_{it-1}, \text{ for} S = E, R \text{ and } j = 1, 2,$$

$$Debt_{it} = \frac{1 + i_{it}}{(1 + \pi_{it})(1 + \Delta y_{it})} Debt_{it-1} + (\exp(g_{it}) - \exp(\tau_{it}))$$

$$F(z_{it}) = \frac{\exp[-\gamma_i z_{it}]}{1 + \exp[-\gamma_i z_{it}]}, \quad \gamma_i > 0.$$

Relating to model (1), Y includes the key macroeconomic variables:

$$Y = [\Delta y \ \Delta\tau \ \Delta g \ i \ \pi],$$

where Δy is GDP growth, $\Delta\tau$ is the change of government revenues (as a fraction of GDP), Δg is the change of government spending (as a fraction of GDP), i is the average cost of government debt and π is the inflation rate. λ_i and χ_t are country and time fixed effects respectively. The error term u_{it} is distributed as a Normal $N(0, \Sigma_u)$, and $i = 1, \ldots, N$ indexes countries and $t = 1, \ldots, T$ indexes time. The policy variable includes the debt-ratio and is specified by (3). For this policy variable, I do not include an error term since, as I discussed in the previous section, this is an "identity".[10] e_{it}^{EB} and e_{it}^{TB} stand for the narratively identified shocks (defined as *shocks* in model (1)). The specification distinguishes between the instrument of stabilization, expenditure-based ($e_{it}^{EB} = e_{it}^{IMF} \cdot EB_{it}$) and tax-based ($e_{it}^{TB} = e_{it}^{IMF} \cdot TB_{it}$) narrative shocks, which are unanticipated and anticipated shocks implemented the same year.[11] In this model I assume that all the macroeconomic variables depend on the cycle, i.e. f_1 which in my case is a weighted sum of the logistic function (2).[12] I follow Granger and Terasvirta (1993) for the estimation of the model.

[10] Of course, one could include an error term to account for measurement error, given the discrepancies that may arise as I discussed in the previous section and are observed in a couple of countries.

[11] e_{it}^{IMF} stands for the the total adjustment, which includes tax and government spending changes. Whereas EB_{it} and TB_{it} are dummy variables for expenditure-based or tax-based cases respectively. An episode is recorded as expenditure-based (tax-based) when the total of expenditure-changes (tax-changes) dominate the total tax-changes (expenditure-changes).

[12] The linear model is a special case of STVAR for a value of $\gamma = 0$.

Including debt in the study of fiscal consolidations is relevant. Indeed, the aim of the narratively identified fiscal consolidations is to reduce public deficits and shore up fiscal sustainability. At the same time, the state of the public finances may not just trigger some episodes of fiscal adjustment, but may also have a direct impact on output growth through a different channel as I discussed in the introduction. Omitting debt may bias the magnitude of the consolidation effects.[13] The reason is that the short lags of $\Delta\tau$, Δg, i and π alone are incapable of tracing the evolution of the debt-ratio accurately enough. Favero and Giavazzi (2007) show that debt in (3) is the result of long and non-linear dynamics.

Since debt plays the role of the "initial condition" that the economy stands, the model dynamics are going to depend on it. This means that the initial value of the state of the economy and the initial value of the government's fiscal position matter for the purpose of studying the different dimensions of interest. I present results with initial values that make clear the dichotomies between a recessionary and expansionary regime (approximately 0.8 versus 0.2 as discussed in the previous section) and a high versus low debt ratio (0.3 and 0.9). Those values are also backed from Figure 3.[14] It is important to stress that with this model I allow for the possible endogenous transition of the economy from one state to the other when a shock hits the economy, and importantly also the endogenous feedback of debt. A flexible way that permits me to actually account and track the transition of the economy and the debt dynamics is the use of the Generalized Impulse Response Functions.

This model makes the non-linearity that is introduced through debt stronger, since the effect from a fiscal adjustment in this case depends on the initial condition of the government's public finances, modelled through the interaction with debt. An "ideal" specification would account for the interaction of both the set of macroeconomic variables and the set of the shocks. However, this translates into a larger number of parameters to be estimated. This is where the so-called "curse of dimensionality" hits. Especially, because of the scarcity of the narrative data.

[13] I elaborate more on this argument in the appendix by discussing the econometrics.

[14] Econometrically, one could also examine whether the "when", the "how", or the "initial condition" is more relevant by testing different hypothesis.

Hypothesis Testing	
Cycle	$B_{1E} = B_{1R}$; $B_{2E} = B_{2R}$
Composition	$B_{1E} = B_{2E}$; $B_{1R} = B_{2R}$
Initial Condition	$B_0^E = B_1^E$; $B_0^R = B_1^R$

4.2 Generalized Impulse Response Functions

I now turn to the derivation of the impulse response functions, which in a non-linear environment may be complicated. The derivation of impulse responses of the variables in Y_{it} to innovations is different from the case of a standard VAR, due to the presence of the logistic function and of the budget constraint. In my setting (model (1)), I compute the response of the output growth (or the rest of the economic aggregates) to fiscal shocks via generalized impulse response functions (Koop, Pesaran and Potter 1996), which make it possible to endogenize the transition from one regime to the other and to track the feedback between debt and the regime.

$$GIRF_{\Delta y}\left(h, \Omega_{t-1}, shock_t\right) = E\left(\Delta y_{t+h} | \Omega_{t-1}, shock_t = 1\right) - E\left(\Delta y_{t+h} | \Omega_{t-1}, shock_t = 0\right),$$

where Ω_{t-1} accounts for the history, $h = 0, 1, 2 \ldots, H$ are the horizons and $shock_t$ represents the shock of interest, which is either the tax-based or the expenditure-based narrative identified shock . I rely on the equation above to derive the impulse response functions.[15] The steps that I follow are:

Step 1. First, assume that the structural shock of interest (i.e. EB or TB) hits the economy, which is equal to one, while the rest of the shocks are equal to zero, and simulate the system forward.

Step 2. Then generate dynamically forward, an alternative simulation for all variables, by assuming, differently from *Step 1*, that all the shocks are equal to zero.

Step 3. To compute the impulse responses, take the difference between the above simulated values of *Steps (1. - 2.)*.

Step 4. In addition, run a correlated bootstrap method for the calculation of the confidence intervals.[16,17]

I repeat the above 4 steps for all the 2^3 combinations of interest.[18] This methodology

[15] Applying this methodology in a linear VAR would produce standard impulse responses.

[16] I report the 16-84% confidence intervals.

[17] For my bootstrap, I re-sample the residuals of the estimated non-linear VAR (e.g. model 4) allowing for the correlation between the residuals of the different countries. This generates a set of observations for $Y, F\left(z\right), Debt$, which allows me to re-estimate my model and derive the GIRFs. I rely on 1000 iterations.

[18] The combinations are: TB shock in recession ($F(z) = 0.8$) when debt is high (0.9); EB shock in recession ($F(z) = 0.8$) when debt is high (0.9); TB shock in expansion ($F(z) = 0.2$) when debt is high (0.9); EB shock in expansion ($F(z) = 0.2$) when debt is high (0.9); TB shock in recession ($F(z) = 0.8$) when debt is

produces impulse responses that allow for the feedback and dynamics of both the state variable $F(z)$ and *Debt*.

5 Results

5.1 The Interacted-STVAR

In Section 4 (Figure 3), I presented how the government debt-to-GDP ratio is distributed along the different percentiles.[19] My econometric specification makes it possible to examine the size of the effects of the coefficients at specific values of the debt-ratio from the percentiles of the sample. I present the impulse response functions together with the endogenous response of debt and the transition of the state of the economy.[20,21]

In Figure 8 and 9 I illustrate the cumulative impulse response functions of the main macroeconomic variables. I focus on the response of the output growth, for scenarios that a consolidation policy was implemented in an economy with a low debt-to-GDP ratio or high debt-to-GDP ratio respectively.In addition, the innovative feature of my model is that I can track the endogenous feedback of the debt-ratio, as well as the endogenous response of the state indicator. Debt is low at a value of 30%, whereas debt is high at the value of 90%.[22] My results represent the behavior of the average country in my sample.

When debt is high (Figure 8), a consolidation policy mainly based on tax increases is self-defeating both in recessions and expansions. The tax shock increases public debt,

low (0.9); EB shock in recession ($F(z) = 0.8$) when debt is low (0.3); TB shock in expansion ($F(z) = 0.2$) when debt is low (0.3); TB shock in expansion ($F(z) = 0.2$) when debt is low (0.3). I set for each case the initial values for debt, the regime indicator, and all the related initial parameters.

[19] I drop Japan from my study, since it is the only country in my sample with such high debt-ratios.

[20] I do not depict the confidence intervals of the response of F(z) and debt. The reason is that they are pretty narrow and I prefer to keep the picture of the graph more clear given that there are many curves presented together.

[21] Differently from AG, I allow for the endogenous transition from one regime to the other ($F(z)$). As it has been already stressed by Caggiano, Castelnuovo, Colombo and Nodari (2015), this is an important point to highlight. Therefore, I document the response of $F(z)$ starting in recession versus the one starting in expansion.

[22] One reason that I choose to present results for these values, is that these values are associated with the point of the tails of my sample distribution as depicted in Figure 3. In addition, the 90% value reflects the discussion of Reinhart and Rogoff (2010) and Herndon, Ash and Pollin (2014) regarding the evidence (or not) of a negative impact of growth when the level of debt ratio is above this threshold.

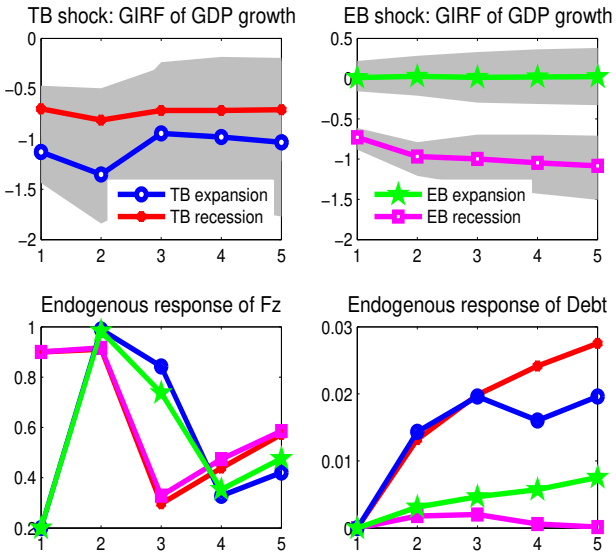

Figure 8: Cumulative GIRFS for the ISTVAR with HIGH Debt: The output growth response on a tax-based shock or an expenditure-based shock in recessions or expansions when the Debt-ratio is high.

which remains on an upward trajectory in the subsequent horizons. The output effect of consolidations based on expenditure cuts appear to depend on the state of the business cycle, that is in recession the effect on output is negative, instead in expansion it is not statistically different from zero. Looking into the behavior of public debt, expenditure-based adjustments appear to be effective in stabilizing debt, independently of the state of the cycle.

When debt is low, from Figure 9, the fiscal effects on output growth generated through increases in taxes are state-dependent. However, this is not the case for expenditure-based consolidations. In a low-debt regime, fiscal consolidations tend to stabilize or even decrease the debt-to-GDP ratio within five horizons. While this is the case for expenditure-based changes independently of the state of the cycle, for tax-based changes implemented in recessions the debt-to-GDP ratio increases.

Differently from the existing literature (Alesina, Azzalini, Favero, Giavazzi and Miano, 2017), I find evidence of state-dependency in the effects of fiscal consolidations when I condition on the level of debt of a country. Overall, considering the three types of asymmetries

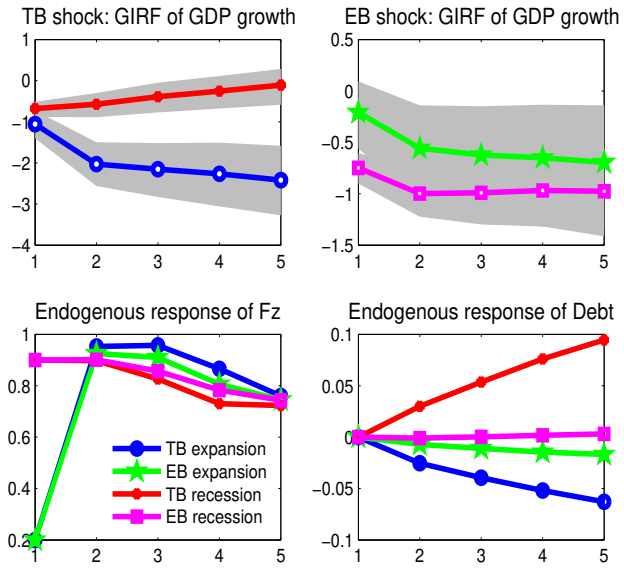

Figure 9: Cumulative GIRFS for the ISTVAR with LOW Debt: The output growth response on a tax-based shock or an expenditure-based shock in recessions or expansions when the Debt-ratio is low.

coming from the "when" — the state of the cycle, the "how" — the composition of the fiscal instrument, the "initial condition" — the level of debt, it appears that the "initial condition" plays a relevant role in the propagation of different consolidation instruments. Policies implemented through expenditure-based adjustments seem to harm the economy less and are effective regarding their objective. They are able to stabilize, and even reduce debt. The picture is different when ones looks into a composition of policies based on tax increases. The distortionary flavour that taxes have, generate an opposite effect from the one that a government of a country would desire. Two factors can explain the increase in public debt, especially in periods of recessions: 1) the negative effect on the output growth and 2) the contemporaneous increase of government spending, which offsets the positive effect of higher revenues on the primary balance. This can be better understood by looking into the debt accumulation equation (3).

In general, the government can engage in decreasing the stock of public debt either by increasing its revenue, by the use of distortionary income taxation, or by reducing its

Table 2: I-STVAR: Output Multiplier in the High-Debt Regime

		Expansion	Recession
TB	Impact	-1.22 $(-1.53, -0.93)$	-0.65 $(-0.89, -0.40)$
	5-year cumulative	-1.02 $(-1.81, -0.36)$	-0.68 $(-1.16, -0.16)$
EB	Impact	-0.046 $(-0.23, 0.18)$	-0.74 $(-0.84, -0.61)$
	5-year cumulative	-0.042 $(-0.40, 0.38)$	-1.12 $(-1.48, -0.70)$

Table 3: I-STVAR: Output Multiplier in the Low-Debt Regime

		Expansion	Recession
TB	Impact	-1.05 $(-1.40, -0.73)$	-0.67 $(-0.88, -0.51)$
	5-year cumulative	-2.42 $(-3.27, -1.58)$	-0.108 $(-0.58, 0.28)$
EB	Impact	-0.21 $(-0.56, 0.09)$	-0.75 $(-0.90, -0.60)$
	5-year cumulative	-0.69 $(-1.41, -0.14)$	-0.97 $(-1.35, -0.63)$

expenditures, for example services that operate as a substitute for private consumption. In terms of policy implications, cutting expenditure seems to be more advisable, since it is less harmful for the economy. A cut in expenditure may reduce the distortion of taxes, since this may imply a decrease of taxation. This can be interpreted as a demand shock in the economy, and for this reason the effect on gdp growth is less pronounced.

Table 2 and Table 3 report the direct impact and five-year output cumulative fiscal multipliers in a high-debt regime and in a low-debt regime.[23]

[23]Ideally, one would construct a multiplier that would capture the direct effect of the shocks on gdp growth and the indirect coming from government revenues or government spending. However, since the shocks in our analysis are not pure shocks (i.e. they are a mix of spending and tax changes), this is not straightforward. In addition, given the number of non-linearities the resulted uncertainty levels can be really high, and therefore not making the results easy to understand or meaningful.

6 Concluding Remarks

The effect of fiscal consolidation measures during economic downturns and when debt is high, is the Gordian knot of policy discussions. In this paper, I contribute to the state-dependent fiscal policy literature by focusing on the effect that the initial debt condition of a country may have in the propagation of a fiscal consolidation policy. I propose an Interacted STVAR aiming to examine the potential asymmetric responses of fiscal consolidations by allowing a non-linearity on the state of the economy, the composition of the fiscal adjustments and the government's fiscal space when the fiscal adjustment is impemented.

Is it the "*how*" — the way the stabilization is performed? Is it the *"when"* — the phase of the cycle? Or is it the *"initial condition"* of the economy — namely, debt — that plays the most pivotal role and potentially constrains fiscal policy under all the different dimensions? In my paper, I highlight the dimension of the *"initial condition"* of debt when a consolidation policy is implemented. This allows me to assess the effectiveness of the different consolidation instruments in stabilising or reducing the debt-to-GDP ratio. I study initial conditions of high and low debt as well as the potential of heterogeneous effects of tax- and expenditure-based fiscal consolidations implemented in bad and good times. Compared to the existing literature, I find evidence of state-dependency. My results indicate that the debt level works as a channel to explain the heterogeneous implications of fiscal adjustments at different stages of the business cycle.

In general, policies implemented through expenditure-based adjustments seem to harm the economy less and work effectively. They are able to stabilize, and even reduce the government debt. The picture is different when I look into a composition of policies based on tax increases. The distortionary flavour that taxes potentially may have, generates an opposite effect from what the government of a country would desire. The effect of tax-based adjustments is, on average, the most recessionary. When debt is high, by increasing taxes the fiscal authority fails to stabilize the debt-ratio. The heterogeneous response of the expenditure-based consolidations implemented during good periods when debt is high is an interesting policy implication that should be examined further. In addition, the evidence of the asymmetries between low and high ratios of debt should be evaluated to understand the channels of the transmission mechanism. For example, it could be important to control for a component of monetary policy, particularly when interest rates are close to the zero lower bound.

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Appendix A Role of Debt

I will discuss econometrically why it is important to include debt. The reason is simple, omitting debt may deliver biased estimates. The aim is to estimate the effect of fiscal adjustments on the output growth. As I discussed in Section 3, the records of the fiscal adjustments are identified in a way that they are exogenous to the business cycle. However, they depend on one key motivation. The motivation is to decrease the government's deficit. Assume a simple model, with a focus just on output growth. Suppose that the true model is the following

$$\Delta y_t = \alpha + \beta \cdot Debt_{t-1} + \gamma \cdot e_t^{IMF} + \varepsilon_t.$$

I can reasonably assume that both $\beta < 0$ and $\gamma < 0$. The latter can be seen also from Figure 12 for the linear case, where the effect of fiscal consolidations has a recessionary effect on output growth. At the same time, I have that

$$e_t^{IMF} = \kappa \cdot Debt_{t-1} + \upsilon_t,$$

where $\kappa > 0$, given the motivation of the fiscal adjustments. If I combine the two equations,

$$\Delta y_t = \alpha + (\frac{\beta}{\kappa} + \gamma) \cdot e_t^{IMF} + \nu_t$$

it is clear that if one considers just the fiscal adjustments, this would imply an overestimation of the effect ($(\frac{\beta}{\kappa}+\gamma) < 0$). Intuitively, in this case, one could also think that the stabilization feedback effect to the system, arising from debt, is missing.

Appendix B Additional Figures and Checks

In this section I briefly discuss part of the preliminary tests regarding the narrative data and some of the building steps needed regarding my baseline model specification.

Appendix B.1 Exogeneity of the narrative identified shocks

To investigate whether the identified adjustments are systematically uncorrelated with other developments affecting output, I use a simple test of exogeneity: the Granger causality test. More precisely, I regress the narrative identified adjustments on the lag of output growth, and augment by including lagged values of the narrative measures. If the past variables are not able to predict a shift in the components of spending or taxes, then the shift is considered to be exogenous.

The results of the Granger causality tests that I run for each country and for each component show that, in most of the cases, the null hypothesis that the past variables predict the narrative measures is rejected. For Sweden and the Netherlands, I am not able to reject the null hypothesis. Therefore, I decided to drop these countries from my analysis.

Appendix B.2 Linearity tests

To make sure that the smooth transition regime switching models are identified, I need to conduct a hypothesis testing of H_0: Linear model versus H_1: Logistic STVAR model. I conduct two typeS of linearity tests. First, I follow Terasvirta and Yang (2014) and use the LM-type test to compare the residual sum of squares of the linear model to the ones of a second- or third-order approximation of the STVAR specification. Then, I use a standard likelihood ratio test. Both tests are in favor of the non-linear model.

To conduct the linearity test I approximate the logistic function by a second- or third-order Taylor expansion. The tests show that the non-linear model performs better compared to the linear model. The values for both the Akaike criterion and the Schwarz criterion are lower for the non-linear model, which indicate that it is the preferred model.

Table 4: Linearity Test

	Linear Model	Non-Linear Model
AIC	4.15	4.06
BIC	4.61	4.5

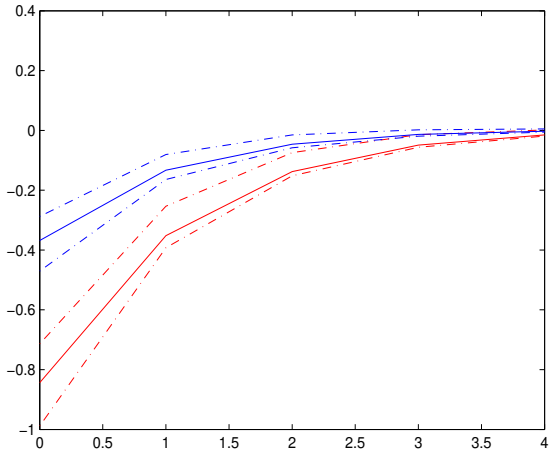

Figure B.1: GIRF for the Linear 3-variate VAR: The output response on a tax-based (red); expenditure-based (blue) fiscal adjustment

The aim in this paper is to account for the three non-linearities and study their relevance to the transmission of fiscal policy. To illustrate this, I first run a linear VAR and look into the asymmetry of tax-based and expenditure-based changed.

Then, I look into the effects of tax-based and expenditure-based consolidations within a smooth-transition VAR, which accounts for the state of the business cycle.

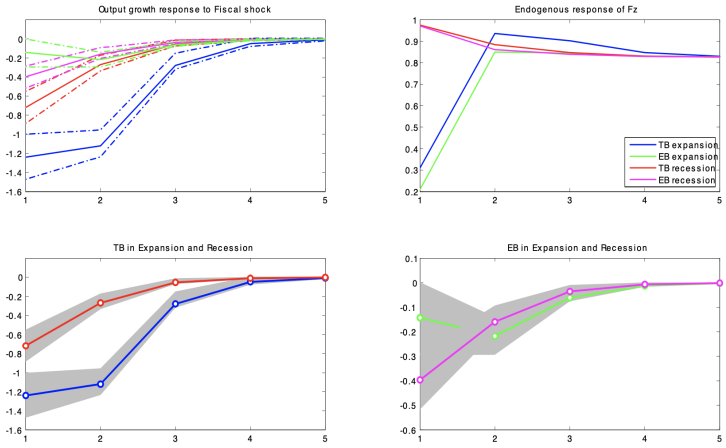

Figure B.2: GIRF for the STVAR: The output response on a tax-based and expenditure-based fiscal adjustments in recessions and expansions

Finally, I look into a fiscal smooth-transition VAR in which I also introduce debt.

The baseline framework that introduces debt reads as follows:

$$Y_{it} = (1 - F(z_{it})) \times \left[A_E Y_{it-1} + \Theta_E Debt_{it-1} + B_{1E} e_{it}^{EB} + B_{2E} e_{it}^{TB}\right] + \\ + F(z_{it}) \times \left[A_R Y_{it-1} + \Theta_R Debt_{it-1} + B_{1R} e_{it}^{EB} + B_{2R} e_{it}^{TB}\right] + \\ + \lambda_i + \chi_t + u_{it} \quad \text{(B.1)}$$

$$Debt_{it} = \frac{1 + i_{it}}{(1 + \pi_{it})(1 + \Delta y_{it})} Debt_{it-1} + (\exp(g_{it}) - \exp(\tau_{it}))$$

$$F(z_{it}) = \frac{\exp[-\gamma_i z_{it}]}{1 + \exp[-\gamma_i z_{it}]}, \quad \gamma_i > 0.$$

When debt is low, the fiscal effects on output growth generated through increases in taxes are state-dependent. Adjustments that are mainly composed through taxes and are implemented in boom periods have the most recessionary effect. This is statistically different from the same type of consolidations when implemented in periods of recessions, which

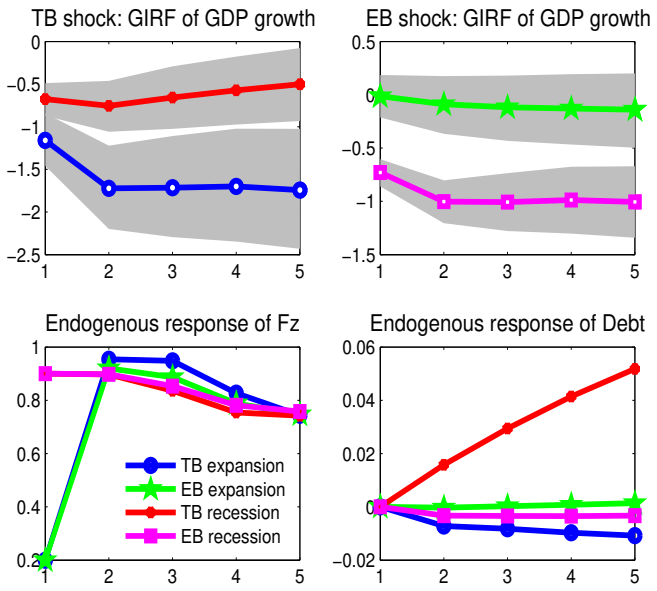

Figure B.3: Cumulative GIRFs for the Fiscal STVAR with LOW Debt: The output growth response on a tax-based shock or an expenditure-based shock in recessions or expansions when the Debt-ratio is low.

appear to be less recessionary. It appears that in bad times, when the economy underperforms and things go bad, they cannot get much worse. The state of the cycle seems to matter also when stabilizations are mainly implemented through increases in government spending. In this case, in periods of expansions the effect on output is almost negligible. In terms of the endogenous response of the transition variable, for all the cases convergence to the assumed probability "target" is observed, which is that the economy spends on average 20% of the time in a recessionary regime. This is not the case when we turn to high debt, where the economy converges in a more recessionary target where the "target" indicates a probability of being 50-60% in a recessionary regime.

When the debt-ratio is high and the phase of the cycle is low, tax changes are self-defeating on average. They bring the debt-ratio to higher levels and the economy converges

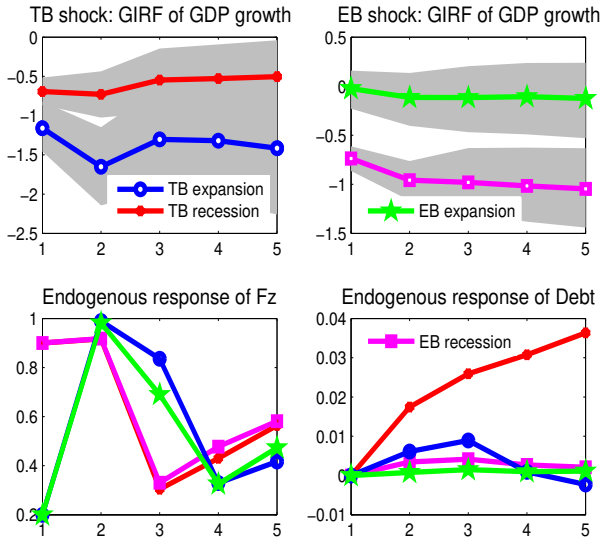

Figure B.4: Cumulative GIRFs for the Fiscal STVAR with HIGH Debt: The output growth response on a tax-based shock or an expenditure-based shock in recessions or expansions when the Debt-ratio is high.

in a recessionary regime. Output growth falls on impact, and even if there is a sign of recovery after one year, it remains in a recessionary regime. Interestingly, on the other hand, government spending adjustments have a stabilizing feedback to debt. Especially, when an expenditure-based fiscal consolidation is implemented during good periods, this leads on average into a negligible response of the output growth. At the same time, it reduces the debt-ratio. Therefore, there is a stabilizing feedback on the economic system.

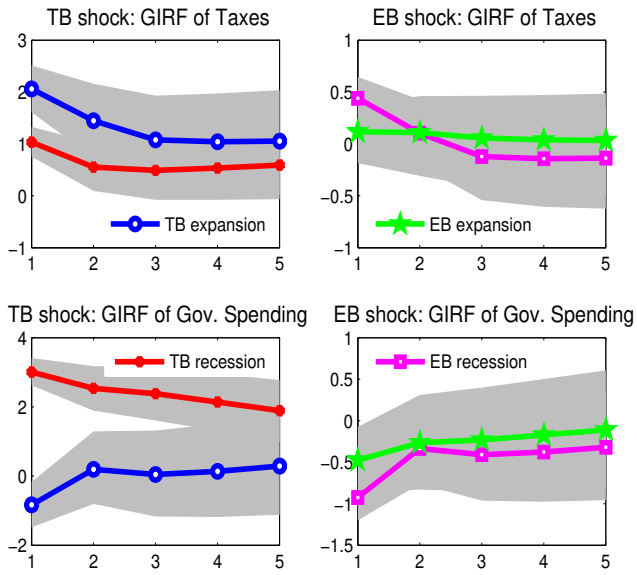

Figure B.5: Cumulative GIRFs for the Fiscal STVAR with LOW Debt: The responses of taxes and government spending on a tax-based shock or an expenditute-based shock in recessions or expansions when the Debt-ratio is low.

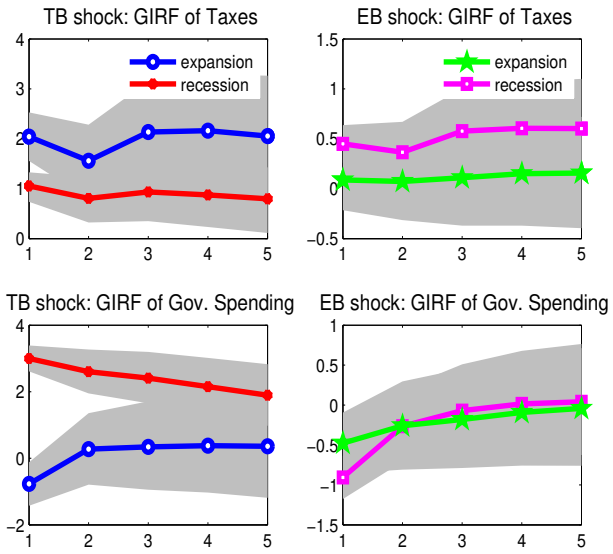

Figure B.6: Cumulative GIRFs for the Fiscal STVAR with HIGH Debt: The responses of taxes and government spending on a tax-based shock or an expenditute-based shock in recessions or expansions when the Debt-ratio is high.

Variable	Coefficient (DeltaY)	Std. Error	T-statistic	Coefficient (DeltaT)	Std. Error	T-statistic	Coefficient (DeltaG)	Std. Error	T-statistic
(1-F)DeltaY	0.4167	0.0893	4.6645	0.0636	0.1313	0.4843	-0.1944	0.1846	-1.0531
(1-F)DeltaT	-0.2313	0.0802	-2.8854	-0.0417	0.1178	-0.3539	0.1177	0.1656	0.7106
(1-F)DeltaG	-0.2070	0.0610	-3.3965	0.0413	0.0896	0.4611	0.2633	0.1259	2.0909
(1-F)i	0.1325	0.0694	1.9099	0.1758	0.1020	1.7241	0.1991	0.1433	1.3890
(1-F)pi	-0.0017	0.0796	-0.0217	0.1477	0.1170	1.2623	-0.1581	0.1644	-0.9611
(1-F)Debt	-0.0083	0.0081	-1.0231	-0.0204	0.0119	-1.7193	-0.0578	0.0167	-3.4652
(1-F)eTB	-0.0129	0.0046	-2.8207	0.0231	0.0067	3.4466	-0.0190	0.0094	-2.0102
(1-F)eEB	0.0020	0.0035	0.5730	-1.1450e-04	0.0051	-0.0224	-0.0036	0.0072	-0.5057
(1-F)DeltaY	0.2041	0.1107	1.8435	0.4104	0.1628	2.5214	-0.3918	0.2287	-1.7129
(1-F)DeltaT	-0.1169	0.0750	-1.5593	-0.0149	0.1102	-0.1353	0.1605	0.1549	1.0362
(1-F)DeltaG	0.0991	0.0348	2.8495	-0.0526	0.0511	-1.0296	-0.3171	0.0718	-4.4155
(F)i	-0.0894	0.0671	-1.3332	-0.0674	0.0986	-0.6841	0.0749	0.1385	0.5405
(F)pi	-0.0202	0.0696	-0.2902	-0.0138	0.1023	-0.1350	0.0153	0.1437	0.1065
(F)Debt	0.0286	0.0078	3.6878	0.0143	0.0114	1.2589	-0.0606	0.0160	-3.7854
(F)eTB	-0.0061	0.0026	-2.3323	0.0086	0.0039	2.2436	0.0358	0.0054	6.6153
(F)eEB	-0.0083	0.0020	-4.1784	0.0049	0.0029	1.6636	-0.0096	0.0041	-2.3383

Figure B.7: Estimation Results of the Fiscal STVAR with Debt (regressors of lag(1) - except from the identified shocks EB,TB)