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The economic effects of fiscal policy: Further evidence for Spain

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ABSTRACT

Previous research considered the impacts of fiscal policy on economic activity in Spain using Vector autoregression (VAR) models. In this paper, we contribute to the existing literature by making use of autoregressive distributed lag estimation procedures that present significant advantages over the VAR alternative. Our econometric methodology is data-driven, and it allows us to select the statistical model that best approximates the relationship between the variables under study and to assess short- and long-run symmetric and asymmetric effects of fiscal policy on output performance. Using quarterly time-series data for Spain covering the period 1980Q1–2020Q4, we offer quantitative estimates of these effects both for aggregated and disaggregated public expenditures and net revenues. These results would be useful for policymakers in the design of a well-informed macroeconomic and public debt management strategy.

1. Introduction

Governments use fiscal policy to influence the broader economy by adjusting their level of spending and tax revenue, usually in a countercyclical way. In particular, the government can use fiscal stimulus to spur economic activity by increasing government spending, decreasing tax revenue, or a combination of the two. Increasing government spending tends to encourage economic activity either directly through purchasing additional goods and services from the private sector or indirectly by transferring funds to individuals who may then spend that money. Decreasing tax revenue tends to encourage economic activity indirectly by increasing individuals' disposable income, which tends to lead to those individuals consuming more goods and services.

Although there is a large empirical literature examining the impact of monetary policy on economic activity, fiscal policy has received relatively less attention. In particular, time series methods that have long been standard in the analysis of monetary policy have been applied to the study of fiscal policy only recently.

The knowledge about the economic effects of fiscal policy is an important element to take into account in the advice and design of public policies, providing guidance in order to obtain eventual fiscal sustainability. Underestimating the short- and long-run impacts of the fiscal policy can lead policymakers to set unattainable fiscal targets and miscalculate the adjustment needed to curb their debt-to Gross Domestic Product (GDP) ratio (Eyraud & Weber, 2013). This could affect the credibility of fiscal consolidation programs. In addition, the authorities may generate repeated rounds of adjustment in an effort to make fiscal variables (deficit, debt) converge to official objectives, undermining the confidence of economic agents and triggering a vicious circle of slow growth, deflation and greater tension.

A strand of the literature has estimated fiscal multipliers as a measure of the short-term impact of discretionary fiscal policy on output. They are typically estimated using Vector autoregression

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(VAR) models to first identify policy changes that are unexpected given the state of the economy and then trace out the effects of these policy innovations on the evolution of the economy and policy. A VAR is an *n*-variable, *n*-equations model, which expresses each variable as a linear function of its own past values, the past values of all other variables being considered, and serially uncorrelated error terms. Fiscal multipliers are then generally defined as the ratio between a change in output and an exogenous change in the fiscal deficit with respect to their respective baselines (see Auerbach & Gale, 2010; Hall, 2009; Ramey, 2011a; Woodford, 2011).

Nevertheless, the need to impose some restrictions on the parameters to estimate the VAR model implies enforcing some structural relationships to transform VAR errors into uncorrelated structural shocks and such restrictions can influence the empirical results. The most common method of identification is the "Cholesky identification" that imposes a causal ordering on the variables in the VAR: shocks to one equation contemporaneously affect variables below that equation but only affect variables above that equation with a lag. As Sims (1980) recognized, economic theory is not rich enough to suggest proper identification restrictions, so the causal ordering a researcher chooses reflects his or her beliefs about the relationships among variables in the VAR.[3] Additionally, assuming that every variable influences every other variable in the system, makes a direct interpretation of the estimated coefficients in the VAR a difficult task.

To avoid these limitations, we make use of the autoregressive distributed lag (ARDL) model developed by Pesaran, Shin, and Smith (2001). This model takes sufficient numbers of lags to capture the data generating process in a general-to-specific modelling framework and integrates the short-run dynamics with the long-run equilibrium without losing long-run information and avoids problems such as spurious relationships resulting from non-stationary time series data. Furthermore, the nonlinear version of the ARDL (NARDL) model introduced by Shin, Yu, and Greenwood-Nimmo (2014) allows using an asymmetric specification that opens the possibility to explore of nonlinear effects of fiscal policy.

In this context, we aim to study the impact of the taxes and expenditure policies of the Spanish public administrations, which can generate results that allow the formulation of proposals to improve the efficiency and redistribution of public provisions, taxes and tax benefits. We consider Spain is an interesting case study because after experiencing high budget deficits, it accomplished an important fiscal consolidation in the 1990s, allowing the country to participate in the Economic and Monetary Union (EMU) from the outset. Furthermore, Spain's public finances were under significant stress during the area sovereign debt crisis (despite pre-crisis fiscal surpluses and low levels of public debt; Martí & Pérez, 2016) and experience a severe impact of the COVID-19 pandemic.

Our contribution to the empirical literature is twofold. First, unlike previous studies, we make use of several time-series techniques to obtain further evidence on the effects of the fiscal policy based on the historical experience of Spain. Second, our econometric methodology is data-driven, and it allows us to select the statistical model that best approximates the relationship between the variables under study and to assess both short and long-run symmetric and asymmetric effects of fiscal policy on output performance.

The rest of the paper is organized as follows. Section 2 provides a brief literature review. Section 3 outlines the methodology and the modelling strategy. Section 4 describes the data used. Empirical results are presented and discussed in Section 5. Finally, Section 6 summarizes the conclusions and the policy implications of the study.

[3] See Rubio-Ramirez, Waggoner, and Zha (2010) for a detailed discussion of identification and other related issues.

2. Literature review

Understanding the impact of changes in government revenues and expenditures on output is a key part of fiscal policy analysis, and the issue periodically comes to the fore as economies move through the stages of economic and political cycles (see, for example, Auerbach & Gorodnichenko, 2012, 2013; Barro & Redlick, 2011; Caggiano, Castelnuovo, Colombo, & Nodari, 2015; Caldara & Kamps, 2017; Hall, 2009; Mertens & Ravn, 2010; Mountford and Uhlig, 2009; Owyang, Ramey, & Zubairy, 2013; Parker, 2011; Ramey, 2011b, 2013; Ramey & Zubairi, 2018; Uhlig, 2010). Likewise, with the rapid increase in public debt levels, there has been a sudden shift towards a consolidation fiscal policy, particularly in continental Europe, which has shifted the focus to the issue of the effect of contractionary fiscal policy, once again revaluing the role of fiscal multipliers (see Alesina and Ardagna (2010); Christelis, Georgarakos, Jappelli, Pistaferri, and van Rooij (2019); and Jorda and Taylor (2016)).

Fiscal multipliers are typically defined as the ratio of a change in output to an exogenous and temporary change in the fiscal deficit relative to its baseline scenario (Spilimbergo, Symansky, & Schindler, 2009). Despite the extensive literature on the matter, there is still no consensus regarding the size of fiscal multipliers: even though they tend to be smaller in more open economies and countries with larger automatic stabilizers, the empirical evidence suggests that they differ widely between countries. While conclusions are still divided, the methodologies employed for identifying multipliers have been sharpened.

Baunsgaard, Mineshima, Poplawski-Ribeiro, and Weber (2014) offer a comprehensive review of the literature on fiscal multipliers, extending and updating the information offered in Spilimbergo et al. (2009). In particular, Baunsgaard et al. (2014) review a total of 37 studies that include both Dynamic Stochastic General Equilibrium (DSGE) models and VAR models, pointing out that the spending multipliers range between 0 and 2.1, with a mean of 0.8 during the first year after taking a given fiscal measure, while government revenue multipliers vary between approximately −1.5 and 1.4, with a mean of 0.3.

Perhaps surprisingly, the empirical literature so far has dealt with the effects of government intervention. Symmetrically, assuming that a contractionary policy has the same effect (mirror image) as an expansionary policy, and the size of the multiplier does not depend on the sign of the change in government income or spending policy. However, theoretical models suggest that, with occasionally binding borrowing constraints, households' marginal propensity to consume in the face of temporary changes in income or spending may be asymmetric (that is, it may depend on the sign of the change in income). In this sense, Bunn, Le Roux, Reinold, and Surico (2018) and Christelis et al. (2019) recently found empirical evidence of asymmetry in the marginal propensity to consume of households. For example, the results of Bunn et al. (2018) suggest that the marginal propensity to consume of households in the face of negative income shocks is above 0.5, while the marginal propensity to consume of households in the face of positive shocks is only 0.1.

Finally, there is empirical evidence suggesting that fiscal multipliers are magnified in recessions (Auerbach & Gorodnichenko, 2013; Baum, Poplawski-Ribeiro, & Weber, 2012), especially when there are financial frictions (Canzoneri, Collard, Dellas, & Diba, 2016).

Regarding the Spanish case, Bajo-Rubio, Díaz-Roldán, and Esteve (2006) using threshold cointegration techniques detect a non-linear relationship between government expenditures and revenues. De Castro and Hernández de Cos (2008) apply the strategy of Blanchard and Perotti (2002) to identify fiscal shocks and estimate fiscal multipliers within a VAR framework using quarterly data for the period 1980Q1–2004Q4. Their results suggest that government expenditure expansionary shocks have positive effects on output in the short term at the cost of higher inflation and public deficits and lower output in the medium and long term. These authors also find that tax increases drag economic activity in the medium term while entailing only temporary improvement of the public budget balance. Later, Ricci-Risquete, Ramajo, and De Castro (2016) estimate a Markov-switching VAR (MSVAR) to account for the nonlinearity of fiscal policy and its relation to different political preferences. Using quarterly data for the period 1986Q1–2012Q4, they find that Spain's membership of EMU implied a policy regimen change. Before increases in the primary deficit-to-GDP ratio did not succeed in stimulating economic activity and after EMU unexpected upsurges in the primary deficit harmed economic activity. Finally, Afonso and St. Aubyn (2019) study the macroeconomic effects of public and private investment in 17 OECD economies through a VAR analysis. From impulse response functions, using annual data from 1979 to 2014, they obtain for Spain a long-run elasticity of output with respect to the public investment of 0.102, in line with the estimated result of 0.079 previously reported by Afonso and St. Aubyn (2009) for the period 1979–2005.

3. Methodology and modelling strategy

This section discusses the methodological framework adopted for the empirical analysis of this research outlining the econometric approaches used to quantify the economic effects of fiscal policy in Spain.

3.1. The symmetric ARDL model

In our particular case, we can write the basic linear ARDL(p,q_1,q_2) model as follows:

$$y_t = \lambda_0 + \sum_{i=1}^{p} \lambda_{1i} y_{t-i} + \sum_{i=1}^{q_1} \lambda_{2i} g_{t-i} + \sum_{i=1}^{q_2} \lambda_{2i} t_{t-i} + \varepsilon_t \quad (1)$$

where y denotes GDP, g stands for public expenditure, t stands for net revenues, λ_0 is the drift component, and ε_t is assumed to be a white noise process.[4] Note that p is the number of lags of the dependent variable and q_i is the number of lags of the i-th explanatory variable. The optimal lag structure of the ARDL model (1) is selected by the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC) to simultaneously correct for residual serial correlation and the problem of endogenous regressors (Pesaran & Shin, 1999, p. 386).

Following Shin et al. (2014), it is straightforward to write the error correction form for the linear ARDL model:

$$\begin{aligned} \Delta y_t &= \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-i} + \sum_{i=1}^{q_1-1} \omega_i \Delta g_{t-i} + \sum_{i=1}^{q_2-1} \varphi_i \Delta t_{t-i} + \lambda_0 \\ &\quad + \sum_{i=1}^{p} \lambda_{1i} y_{t-i} + \sum_{i=1}^{q_1} \lambda_{2i} g_{t-i} + \sum_{i=1}^{q_2} \lambda_{3i} t_{t-i} + \upsilon_t \\ &= \beta ECT_{t-1} + \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-i} + \sum_{i=1}^{q_1-1} \omega_i \Delta g_{t-i} + \sum_{i=1}^{q_2-1} \varphi_i \Delta t_{t-i} + \upsilon_t \end{aligned} \quad (2)$$

where Δ denotes the first difference operator, υ_t is assumed to be a white noise process, and $ECT_{t-1} = y_{t-1} - \beta_0 - \beta_1 g_{t-1} - \beta_2 t_{t-1}$is the error-correction term where $\beta_0 = \frac{-\lambda_0}{1-\sum_{i=1}^{p}\lambda_{1i}}$,$\beta_1 = \frac{\sum_{i=1}^{q_1}\lambda_{2i}}{1-\sum_{i=1}^{p}\lambda_{1i}}$and $\beta_2 = \frac{\sum_{i=1}^{q_2}\lambda_{3i}}{1-\sum_{i=1}^{p}\lambda_{1i}}$are the associated long-run multipliers (i. e. measures of the long-term impact of a discretionary fiscal policy change on g and t on output).

In a similar vein, following Hendry (1995)'s suggestion, we calculate the short-term multipliers (i. e. measures of the long-term effect of a discretionary fiscal policy change on g and t on output) as follows:

$$S_g = \sum_{i=1}^{q_1-1} \omega_i \Big/ \left(1 - \sum_{i=1}^{p-1} \gamma_i\right) \quad (3)$$

$$S_t = \sum_{i=1}^{q_2-1} \varphi_i \Big/ \left(1 - \sum_{i=1}^{p-1} \gamma_i\right) \quad (4)$$

Analogous models can be derived to successively explore the effects of disaggregated government expenditures and net revenues.

3.2. The asymmetric ARDL model

By employing the approach of Shin et al. (2014), we decompose both public expenditure and net revenues into asymmetric multipliers: the partial sums of positive and negative changes of those variables indicating increasing values of g and t (with a positive superscript) and reductions of g and t (with a negative superscript).

We defined these partial sums for g and t changes as follows:

$$g_t^+ = \sum_{j=1}^{t} \Delta g_j^+ = \sum_{j=1}^{t} \max(\Delta g_j, 0)$$

$$g_t^- = \sum_{j=1}^{t} \Delta g_j^- = \sum_{j=1}^{t} \min(\Delta g_j, 0)$$

$$t_t^+ = \sum_{j=1}^{t} \Delta t_j^+ = \sum_{j=1}^{t} \max(\Delta t_j, 0)$$

$$t_t^- = \sum_{j=1}^{t} \Delta t_j^- = \sum_{j=1}^{t} \min(\Delta t_j, 0)$$

To explore the asymmetric effects of public expenditure and net revenues on GDP, we consider the general case of Shin et al. (2014) and formulate an unrestricted error correction model with both long-run and short-run asymmetries:

$$\begin{aligned} \Delta y_t &= \beta + \sum_{i=1}^{p} \gamma_i \Delta y_{t-i} + \sum_{i=1}^{q_1} \omega_i^+ \Delta g_{t-1}^+ + \sum_{i=1}^{q_2} \omega_i^- \Delta g_{t-1}^- + \sum_{i=1}^{q_3} \varphi_i^+ \Delta t_{t-1}^+ \\ &\quad + \sum_{i=1}^{q_4} \varphi_i^- \Delta t_{t-1}^- + \lambda_1 y_{t-1} + \lambda_2^+ g_{t-1}^+ + \lambda_2^- g_{t-1}^- + \lambda_3^+ t_{t-1}^+ + \lambda_3^- t_{t-1}^- + \varepsilon_t \end{aligned} \quad (5)$$

where $L_{g^+} = \frac{-\lambda_2^+}{\lambda_1}$,$L_{g^-} = \frac{-\lambda_2^-}{\lambda_1}$, $L_{t^+} = \frac{-\lambda_3^+}{\lambda_1}$,and $L_{t^-} = \frac{-\lambda_2^-}{\lambda_1}$are the long-run multipliers of positive and negative changes of public expenditure and net revenues to GDP, respectively. The positive and negative superscripts stand for the partial sums of positive and negative changes of g and t.

As in the symmetric case, further models can be derived to successively explore the effects of different components of government spending and net taxes.

4. Data and time-series properties

4.1. Data

To maintain homogeneity, we use the REMSDB macroeconomic database of the Spanish economy (Boscá et al., 2007). The REMSDB database offers quarterly time series covering the period 1980Q1–2020Q4 that have been adjusted for seasonal and calendar effects. It is built from official statistics and provides a useful tool in macroeconomic analysis thanks to the homogenisation of the historic series it contains. The REMSDB database allows us to have a total of 164 quarterly observations to capture the underlying relationship between the variables under study.

In particular, we use data for GDP (y), public expenditure (g), net revenues (i.e., public revenues net of transfers) (t), public consumption ($g1$), public investment ($g2$), public wage bill ($g3$), net indirect taxes (i.e., taxes on production and imports net of subsidies on production) ($t1$), net direct taxes (i.e., current taxes on income and

[4] Although related papers have considered directly the feedback from government debt when examining the effects of fiscal policy shocks (see, for example, Favero & Giavazzi, 2008; and Afonso & Sousa, 2012), we do not take this transmission mechanism in this paper. In future extensions, we will address this issue.

Table 1
Augmented Dickey-Fuller tests for unit roots.

Panel A: I (2) versus I (1) (Variables in first differences)			
	τ_τ	τ_μ	τ
y	-3.9351***	-3.8579***	-3.1676***
g	-3.5833**	-3.6508***	-3.6697***
t	-3.9375**	-3.6908***	-3.3515***
g1	-4.2278***	-4.2211***	-2.8411***
g2	-4.2161***	-4.0806***	-4.0843***
g3	-4.5309***	-4.5439***	-3.0176***
t1	-4.3752***	-4.2537***	-4.0480***
t2	-3.5775**	-3.4424**	-3.2397***
t3	-3.4726**	-3.4865***	-2.7847***
Panel B: I (1) versus I (0) (Variables in levels)			
	τ_τ	τ_μ	τ
y	-0.6689	-1.6358	0:6964
g	-2.7339	-0.5406	0.8938
t	-2.5212	0.4850	0.08901
g1	-2.4763	0.5819	1.0422
g2	-1.5863	-1.8849	-0.2428
g3	-2.0105	-0.2690	-1.3932
t1	-2.9447	-1.7221	0.7006
t2	-2.7052	-0.2045	1.0233
t3	-3.0222	-1.1929	1.2000

Notes:
The ADF statistic is a test for the null hypothesis of a unit root.
τ_τ, τ_μ and τ denote the ADF statistics with drift and trend, with drift, and without drift, respectively.
The symbols ***, ** and * correspond to statistical significance at 1, 5 and 10 per cent, respectively. Critical values are based on MacKinnon (1996).

Table 2
KPSS tests for stationarity.

Panel A: I (2) versus I (1) (Variables in first differences)		
	τ_τ	τ_μ
y	0.1048	0.1758
g	0.0933	0.0707
t	0.0560	0.1962
g1	0.0902	0.1005
g2	0.0534	0.2311
g3	0.0493	0.0492
t1	0.0582	0.1840
t2	0.0394	0.1311
t3	0.0856	0.0846
Panel B: I (1) versus I (0) (Variables in levels)		
	τ_τ	τ_μ
y	0.2881***	1.5329***
g	0.2505***	1.4979***
t	0.3515***	1.4308***
g1	0.2867***	1.5659***
g2	0.2420***	1.4307***
g3	0.2819***	1.5618***
t1	0.2461***	1.4135***
t2	0.1957**	1.2459***
t3	0.1740**	1.5375***

Notes:
The KPSS statistic is a test for the null hypothesis of stationarity.
τ_τ and τ_μ denote the KPSS statistics with drift and trend, and with drift, respectively.
*,**, and *** denote significance at the 1 %, 5 % and 10 % levels. Asymptotic critical values based on Kwiatkowski, Phillips, Schmidt, Shin et al. (1992, Table 1).

wealth net of current transfers) (*t2*) and social security contributions (*t3*), all expressed in real terms.[5]

4.2. Time series properties

Even though the methodology used in this paper allows for a mixture of stationary I(0) series and non-stationary I(1) series in the estimation of the error correction model Given that most macroeconomic data exhibit non-stationary, we tested for the order of integration of the variables under study using the Augmented Dickey-Fuller (ADF) tests to verify all variables are either I(0) series or I(1) series. Table 1 reports the results. As can be seen, we do not reject the null hypothesis of a unit root at conventional significance levels for all the variables, suggesting that they can be treated as first-difference stationary.[6]

Following Cheung and Chinn (1997)'s suggestion, we confirm these results using the Kwiatkowski, Phillips, Schmidt, and Shin Y (1992) (KPSS) tests, where the null is a stationary process against the alternative of a unit root. As can be seen in Table 2, we reject the null hypothesis of stationarity at conventional significance levels for all the variables, giving further support to our previous results.

[5] Except for public consumption (where its own deflator is used), in all cases, the GDP deflator is employed to obtain the corresponding real values expressed at constant 2015 market prices.

[6] These results were confirmed using Phillips and Perron (1998) unit root tests controlling for serial correlation and heteroskedasticity in the errors, the Elliott, Rothenberg, and Stock (1996)'s modified ADF- generalized least squares unit root tests and the Ng and Perron (2001)'s modified efficient Phillips-Perron. These additional results are also available from the authors.

5. Empirical results

5.1. Empirical results for the aggregated fiscal policy

We first assess the impact of total public expenditure and aggregated net revenues. As mentioned before, we choose the optimal lag structure of the ARDL and NARDL using the AIC and SBC. This gives an ARDL(4,0,2) for the symmetric specification and an ARDL(4, 3, 2, 1, 2) for the asymmetric model. Then we implement a general-to-specific modelling approach to obtain our parsimonious final models presented in Tables 3 and 4, respectively.

As can be seen in Panel A of Table 3, in the ARDL model, the short-run coefficients of the net revenues are negative and statistically significant at the conventional level, while the dynamic lags for the public expenditure are not significant. These results lead to an estimated short-term multiplier for the net revenues of −1.1468 (Panel C of Table 3). These findings are consistent with the estimated fiscal impacts on growth based on VAR analysis reported by Afonso and St. Aubyn (2009, 2019) for the Spanish case using different periods. In relation to the NADRL model, in Panel A of Table 4, we observe that two out of three short-term coefficients for positive partial sums of the public expenditure are positive and significant at least at the five per cent level, while the negative partial sums of public expenditure are all negative and statistically significant. Regarding the net revenues, the results suggest that the coefficient for their positive (negative) partial sums are all negative and statistically significant. The associated short-run multipliers are$S_{g_t^+}$=3.8855 $S_{g_t^-}$= −3.1401, $S_{t_t^+}$=-1.1403 and $S_{t_t^-}$=-2.1744 (Panel C of Table 4). These findings indicate that increments in public expenditure and reductions in net revenues contribute to economic growth in the short term, while declines in public expenditure or rises in net revenues have a dampening short-run effect on growth. Note also that in both models two out of three short-run statistically significant coefficients for the GDP are negative. Finally, as can be seen in Tables 2 and 3, the estimated coefficients of the error correction term show the

Table 3
Symmetric ARDL specification for fiscal policy.

Panel A: Short-run coefficient estimates					
Lag Order					
	0	1	2	3	4
Δy_t		-0.4847*** (0.0835)	-0.7745*** (0.1175)	0.4970* (0.2760)	
Δg_t					
Δt_t	-1.0976*** (0.4142)	-0.9233** (0.4244)			
Panel B: Long-run coefficient estimate					
Lag Order					
	0	1	2	3	4
Constant	-8319.71** (4090.75)				
y_t		0.5559*** (0.1788)	-0.2897* (0.1742)	0.2715** (0.1295)	-0.4970** (0.2355)
g_t	0.6637** (0.3162)				
t_t	-0.1976*** (0.0738)	-0.2296** (0.1095)	-0.9233** (0.4417)		
Panel C: Long-run multipliers					
L_g=0.6918**, L_t = −1.4077**					
Panel D: Short-run multipliers					
S_t = −1.1468**					
Panel E: Diagnostic statistics					
ECT	$AdjR^2$	AIC			
-0.4061*** (0.0829)	0.64	19.7306			

Notes:
y denotes GDP, g is public expenditure and t stands for public net revenues, all expressed in real terms.
Standard errors in parentheses.
The symbols ***, ** and * correspond to statistical significance at 1, 5 and 10 per cent, respectively.

Table 4
Asymmetric ARDL specification for fiscal policy.

Panel A: Short-run coefficient estimates					
Lag Order					
	0	1	2	3	4
Δy_t		-0.5394*** (0.069 5)	-0.8213*** (0.1053)	0.4734** (0.2205)	
Δg_t^+	4.5885*** (1.0467)	-0.4215** (0.1963)	3.1664*** (1.0106)		
Δg_t^-	-2.8349** (1.3204)	-3.0917*** (0.9910)			
Δt_t^+	-2.1522** (0.3154)				
Δt_t^-	-0.6775** (0.3155)	-3.4264*** (0.7554)			
Panel B: Long-run coefficient estimates					
Lag Order					
	0	1	2	3	4
Constant	23936.99** (11764.34)				
y_t		0.2686** (0.1298)	-0.2819*** (0.0909)	1.2947** (0.5906)	-0.4734** (0.2279)
g_t^+	4.5885*** (1.5449)	-3.7677** (1.8289)	3.5879*** (1.1920)	-3.1664** (1.3998)	
g_t^-	-2.8349* (1.5516)	-1.2301*** (0.4142)	3.0917** (1.5290)		
t_t^+	-0.1522* (0.0673)	-0.3737*** (0.1258)			
t_t^-	0.6775** (0.3350)	-0.8738*** (0.2793)	-0.4264*** (0.1915)		
Panel C: Long-run multipliers					
$L_{g_t^+}$=6.4724**, $L_{g_t^-}$= −5.0707**, $L_{t_t^+}$=-2.7397**, $L_{t_t^-}$=-4.0255***					
Panel D: Short-run multipliers					
$S_{g_t^+}$=3.8855***, $S_{g_t^-}$= −3.1401**, $S_{t_t^+}$=-1.1403**, $S_{t_t^-}$=-2.1744***					
Panel E: Diagnostic statistics					
ECT	$AdjR^2$	AIC			
-0.4920*** (0.1109)	0.66	19.40			

Notes:
y denotes GDP, $g_t^+(g_t^-)$ is the partial sums for positive (negative) changes in public expenditure and $t_t^+(t_t^-)$ stands for the partial sums for positive (negative) changes *in* public net revenues, all expressed in real terms.
Standard errors in parentheses.
The symbols ***, ** and * correspond to statistical significance at 1, 5 and 10 per cent, respectively.

expected sign, being also statistically significant, indicating that the null hypothesis of no error correction term is strongly rejected in both cases, providing support to the existence of a long-run relationship between the variables under study (Banerjee, Dolado, & Mestre, 1998). In particular, the error correction term varies between −0.4920 for the ARDL model and −0.4061 for the NARDL, indicating that, on average, any deviation from the long-run equilibrium caused by an external shock in the previous period is corrected approximately by 49 % and 40 %, respectively.

As concerns to the long-run dynamics, in the symmetric ARDL model (Panel B of Table 4) we obtain a positive and statistically significant long-run coefficient for public expenditures and negative and significant coefficients for net revenues, being the associated long-run multipliers L_g = 0.6918 and L_t = −1.4077 (Panel D of Table 3). For the NARDL model, two out of four long-term coefficients for positive partial sums of public expenditure are positive and significant and two out of three long-term coefficients for negative partial sums are positive and significant as we can note in Panel B of Table 4. For the net revenues, our results indicate that all long-term coefficients for their positive and negative partial sums are negative and statistically significant. The associated long-run multipliers are as follows: $L_{g_t^+}$=6.4724, $L_{g_t^-}$= −5.0707, $L_{t_t^+}$=-2.7397 and $L_{t_t^-}$=-4.0255. Therefore, our results suggest asymmetric long-run effects on GDP of both public expenditure and net revenues, with a relatively higher impact of increasing both public expenditure and decreasing net revenues.

5.2. Empirical results for public expenditures

We proceed further by exploring the possibility of different responses of GDP to expenditure components, Tables 5 and 6 report the empirical results obtained for the ARDL and NARDL models, respectively.

Table 5
Symmetric ARDL specification for public expenditures.

Panel A: Short-run coefficient estimates

Lag Order	0	1	2	3	4
Δy_t		-0.2330***	-0.4225***	0.8415***	
		(0.0790)	(0.1319)	(0.2730)	
$\Delta g1_t$	2.7953**	-0.2567***			
	(1.2010)	(0.0899)			
$\Delta g2_t$					
$\Delta g3_t$					

Panel B: Long-run coefficient estimates

Lag Order	0	1	2	3	4
Constant	5901.49**				
	(2810.23)				
y_t		0.7668***	-0.1895**	0.2640**	-0.8415**
		(0.1584)	(0.0907)	(0.1245)	(0.2697)
$g1_t$	2.7953***	1.6608**	2.2567**		
	(0.7287)	(0.8066)	(1.0902)		
$g2_t$	2.1717***				
	(0575)				
$g3_t$	0.9456***				
	(0.3040)				

Panel C: Long-run multipliers
L_{g1}=4.4553**, L_{g2}=2.1713**, L_{g3}=0.9454***

Panel D: Short-run multipliers
S_{g1}=3.1188***

Panel E: Diagnostic statistics

ECT	$AdjR^2$	AIC
-0.4172***	0.67	19.3122
(0.1231)		

Notes:
y denotes GDP, *g1* is public consumption, *g2* stands for public investment and *g3* denotes public wage bill, all expressed in real terms.
Standard errors in parentheses.
The symbols ***, ** and * correspond to statistical significance at 1, 5 and 10 per cent, respectively.

In the final parsimonious model to account for the short-run dynamics derived from the selected ARDL(4,2,0,0) model (Panel A of Table 5), we only find a positive and statistically significant for public consumption, with an associated short-term multiplier of 3.1188 (Panel C of Table 5). In the NADRL model, we observe that the two short-term coefficients for positive partial sums of public consumption are positive and significant at the conventional level, while the negative partial sums of public consumption are negative and statistically significant (Panel A of Table 6). In this case, the associated short-run multipliers are$S_{g1_t^+}$=3.9202 and $S_{g1_t^-}= -6.2561$ (Panel C of Table 6). These findings indicate that increments in public consumption enhance growth in the short term, while declines in public consumption have a diminishing short-run impact on growth. Note also that, once again, in both models two out of three short-run statistically significant coefficients for the GDP are negative. Finally, the estimated coefficients of the error correction are negative and statistically significant, suggesting that any deviation from the long-run equilibrium is corrected approximately by 44 % in the ARDL model and by 42 % in the NARDL model.

Table 6
Asymmetric ARDL specification for public expenditures.

Panel A: Short-run coefficient estimates

Lag Order	0	1	2	3	4
Δy_t		-0.2782***	-0.5113***	0.6295**	
		(0.0773)	(0.1336)	(0.2689)	
$\Delta g1_t^+$	-0.6701***	-3.8773**			
	(0.2130)	(1.5058)			
$\Delta g1_t^-$	-7.2570**				
	(2.8902)				
$\Delta g2_t^+$					
$\Delta g2_t^-$					
$\Delta g3_t^+$					
$\Delta g3_t^-$					

Panel B: Long-run coefficient estimates

Lag Order	0	1	2	3	4
Constant	-958.41**				
	(429.28)				
y_t		0.7217***	-0.2331***	1.0141**	-0.6295***
		(0.1493)	(0.0811)	(0.4915)	(0.2176)
$g1_t^+$	0.6701***	-3.8762**	3.8773***		
	(0.2502)	(1.8597)	(1.3369)		
$g1_t^-$	7.2570***	-7.3446***			
	(1.9487)	(1.7965)			
$g2_t^+$	1.0566***				
	(0.3612)				
$g2_t^-$	-0.7624***				
	(0.2397)				
$g3_t^+$	0.5630***				
	(0.2011)				
$g3_t^-$	-0.6116***				
	(0.2106)				

Panel C: Long-run multipliers
$L_{g1_t^+}$=5.2918***, $L_{g1_t^-}$= −0.5901***, $L_{g2_t^+}$=8.3292***, $L_{g2_t^-}$=-6.0010***, $L_{g3_t^+}$=4.4386***, $L_{g2_t^-}$=-3.8571***

Panel D: Short-run multipliers
$S_{g1_t^+}$=3.9202***, $S_{g1_t^-}$= −6.2561**

Panel E: Diagnostic statistics

ECT	$AdjR^2$	AIC
-0.4370***	0.62	19.8817
(0.1419)		

Notes:
y denotes GDP, $g1_t^+(g1_t^-)$ is the partial sums for positive (negative) changes in public consumption, $g2_t^+(g2_t^-)$ stands for the partial sums for positive (negative) changes in public investment, and $g3_t^+(g3_t^-)$ denotes the partial sums for positive (negative) changes in the public wage bill, all expressed in real terms.
Standard errors in parentheses.
The symbols ***, ** and * correspond to statistical significance at 1, 5 and 10 per cent, respectively.

With reference to the long-run dynamics, in the symmetric ARDL model (Panel B of Table 4) we obtain a positive and statistically significant long-run coefficient for public consumption, public investment and public wage bill, being the associated long-run multipliers L_{g1} = 4.4553, L_{g2} = 2.1713 and L_{g3} = 0.9454, respectively (Panel D of Table 4). For the selected NARDL(4, 2, 1, 0, 0, 0, 0), two of four long-term coefficients for positive partial sums of the public consumption are positive and significant and one of the two the

Table 7
Symmetric ARDL specification for net revenues.

Panel A: Short-run coefficient estimates					
Lag Order					
	0	1	2	3	4
Δy_t		-0.8226*** (0.0858)	-1.0913*** (0.1177)		
$\Delta t1_t$	-0.6442** (0.3112)	-4.3394*** (0.9164)			
$\Delta t2_t$	-1.6231*** (0.5833)	-2.4749*** (0.7131)	-1.2218*** (0.5512)		
$\Delta t3_t$					
Panel B: Long-run coefficient estimates					
Lag Order					
	0	1	2	3	4
Constant	1140.20** (550.82)				
y_t		0.4005*** (0.1467)	-0.2687** (0.1273)	0.0913*** (0.0388)	
$t1_t$	-0.6442** (0.7841)	-0.2319*** (0.1099)	-1.3394*** (0.4604)		
$t2_t$	-1.6231** (4.5722)	4.6094** (2.0057)	-3.6967*** (1.1963)	2.2218*** (0.8139)	
$t3_t$	-0.7864*** (0.2529)				
Panel C: Long-run multipliers					
L_{t1}=−2.8519**, L_{t2}=−1.9454**, L_{t3}=−1.0123**					
Panel D: Short-run multipliers					
S_{t1}=−1.7103***, S_{t2}=−2.7796***					
Panel E: Diagnostic statistics					
ECT	AdjR^2	AIC			
-0.4608*** (0.1019)	0.67	19.5218			

Notes:
y denotes GDP, *t1* is indirect taxes net of subsidies, *t2* stands for direct taxes net of transfers and *t3* denotes social security contributions, all expressed in real terms.
Standard errors in parentheses.
The symbols ***, ** and * correspond to statistical significance at 1, 5 and 10 per cent, respectively.

long-term coefficients for negative partial sums is positive and significant, as we can note in Panel B of Table 4. For the public investment and the public wage bill, our results suggest that the long-term coefficients for their positive partial sums are positive and statistically significant and that the long-term coefficient for their negative partial sums is negative and significant. The associated long-run multipliers are as follows: $L_{g1_t^+}$=5.2918, $L_{g1_t^-}$= −0.5901, $L_{g2_t^+}$=8.3292, $L_{g2_t^-}$=-6.0010, $L_{g3_t^+}$=4.4386 and$L_{g3_t^-}$=-3.8571. Consequently, our results indicate asymmetric long-run effects on GDP for the different categories of public expenditures under study, with a relatively higher intensifying impact for expanding expenditures than for declining expenditures.

5.3. Empirical results for the net taxes

Turning to the case of the effects on GDP of different components of public net revenues, Tables 7 and 8 present, respectively, the empirical results obtained for the ARDL and NARDL models.

In connection with the symmetric case, the selected ARDL(3, 2, 3, 0) model rendered an estimated final parsimonious dynamic model with positive and statistically significant coefficients for variations in both indirect taxes net of subsidies and direct taxes net of transfers, but no short-term effect is found for changes in social security contributions (Panel A of Table 7). The associated short-term multipliers are S_{t1} =−1.7103 and S_{t2} =−2.7796 (Panel C of Table 7). In the selected NARDL(3, 0, 2, 1, 4, 0, 0) model, we observe that the short-term coefficients for negative partial sums of indirect taxes net of subsidies are negative and significant at the conventional level, while the short-term coefficients for positive and negative partial sums of direct taxes net of transfers are all also negative and statistically significant (Panel A of Table 8). No significant short-run impact on growth is found for positive partial sums of the indirect taxes net of subsidies or the partial sums of social security contributions. The associated short-run multipliers are$S_{t1_t^-}$= −3.2214, $S_{t2_t^+}$=-2.7697 and $S_{t2_t^-}$=-1.7576 (Panel C of Table 8). These results suggest that expansions of direct taxes net of transfers lessen growth in the short term, while diminutions in indirect taxes net of subsidies and direct taxes net of transfers boost growth in the short term. Note also that in both models the two short-run coefficients for the GDP are negative and statistically significant. Finally, the estimated coefficients of the error correction are negative and statistically significant, suggesting that any deviation from the long-run equilibrium is corrected approximately by 46 % in the ARDL model and by 43 % in the NARDL model.

As for the long-run dynamics, in the symmetric ARDL model (Panel B of Table 7), we obtain all negative and significant long-term coefficients for both indirect taxes net of subsidies and social security contributions and two out of four negative and significant long-term coefficients for, being the associated long-run multipliers L_{t1} =−2.8519, L_{t2} =−1.9454 and L_{t3} =−1.0123, respectively (Panel D of Table 7). For the selected NARDL(4, 2, 1, 0, 0, 0, 0), the long-term coefficients for positive and negative partial sums of indirect taxes net of subsidies and social security contributions are negative and significant, while the long-term coefficient for positive partial sums of direct taxes net of transfers is negative and significant and four of the fiver long-term coefficients for negative partial sums of direct taxes net of transfers are negative and significant (Panel B of Table 8). The associated long-run multipliers are as follows: $L_{t1_t^+}$=-3.3144, $L_{t1_t^-}$= −2.7697, $L_{t2_t^+}$=-5.8571, $L_{t2_t^-}$=-4.4152, $L_{t3_t^+}$=-4.2734 and, $L_{t3_t^-}$=-3.8022. Accordingly, our empirical results indicate asymmetric long-run effects on GDP for the different categories of net revenues examined, with relatively higher negative effects for diminishing revenues than for rising revenues.

Table 8
Asymmetric ARDL specification for net revenues.

Panel A: Short-run coefficient estimates

Lag Order	0	1	2	3	4
Δy_t		-0.8635*** (0.0799)	-1.0246*** (0.1039)		
$\Delta t1_t^+$					
$\Delta t1_t^-$	-2.3509*** (0.7147)	-2.5843*** (0.4104)			
$\Delta t2_t^+$	-0.6266*** (0.2050)				
$\Delta t2_t^-$	-0.8105*** (0.2347)	-1.3350*** (0.3150)	-0.4136*** (0.1400)	-0.4400*** (0.2179)	
$\Delta t3_t^+$					
$\Delta t3_t^-$					

Panel B: Long-run coefficient estimates

Lag Order	0	1	2	3	4
Constant	-14398.65** (5624.75)				
y_t		-0.2826*** (0.1022)	-0.1611*** (0.0521)	1.2456** (0.4868)	
$t1_t^+$	-0.6564*** (0.2170)				
$t1_t^-$	-0.2544** (0.0862)	-0.0993** (0.0493)	-0.1948** (0.0945)		
$t2_t^+$	-0.6266*** (0.2150)	-0.5331** (0.2606)			
$t2_t^-$	-0.1811*** (0.0602)	-0.1783** (0.0884)	-0.3485** (0.1696)	-0.0264*** (0.0097)	0.1400** (0.0684)
$t3_t^+$	-0.8463*** (0.2867)				
$t3_t^-$	-0.7529*** (0.2431)				

Panel C: Long-run multipliers
$L_{t1_t^+}$=-3.3144**, $L_{t1_t^-}$= −2.7697**, $L_{t2_t^+}$=-5.8571***, $L_{t2_t^-}$=-4.4152**, $L_{t3_t^+}$=-4.2734***, $L_{t3_t^-}$=-3.8022**

Panel D: Short-run multipliers
$S_{t1_t^-}$=-3.2214**, $S_{t2_t^+}$=-2.2945***, $S_{t2_t^-}$=-1.9576***

Panel E: Diagnostic statistics

ECT	$AdjR^2$	AIC
-0.4264*** (0.1317)	0.67	19.3832

Notes:
y denotes GDP, $t1_t^+(t1_t^-)$ is the partial sums for positive (negative) changes in indirect taxes net of subsidies, $t2_t^+(t2_t^-)$ stands for the partial sums for positive (negative) changes in direct taxes net of transfers, and $t3_t^+(t3_t^-)$ denotes the partial sums for positive (negative) changes in social security contributions, all expressed in real terms.
Standard errors in parentheses.
The symbols ***, ** and * correspond to statistical significance at 1, 5 and 10 per cent, respectively.

6. Concluding remarks

Academic literature has examined the influence of fiscal policy on economic activity using different econometric techniques. This paper has tried to shell light on this issue by empirically investigating the short- and long-run impact of aggregated fiscal policy public and some disaggregated categories of public expenditure and public revenues on economic growth in Spain. To that end, we have used quarterly data for the period 1980Q1–2020Q4 and made use of the symmetric and asymmetric ARDL modelling approach.

As in every empirical analysis, the results of this paper must be treated with some caution since they are obtained using a certain time period and based on a given econometric methodology. In this context, our findings suggest that increments in public expenditure and reductions in net revenues contribute in Spain to the economic growth in the short and long term, while declines in public expenditure or rises in net revenues have dampened short-run and long-run effects on growth. When examining the role of different categories of public expenditure and net revenues, our results suggest a higher enhancing impact on economic performance for expanding expenditures than for declining expenditures.net revenues, and when assessing the heterogeneous effects of different components of net revenues, we find that a relatively higher negative effect on growth for diminishing revenues than for rising revenues. Our results are broadly in line with previous VAR studies for the case of Spain (de Castro and Hernández de Cos, 2008).

We consider that our empirical result would be useful for policymakers in the design of a well-informed macroeconomic and public debt management strategy.

The evidence presented in this paper opens the door to investigate not only the experience of other euro area countries but also the potential heterogeneous effects of different categories of public expenditures and revenues. Therefore, a natural extension of the analysis presented in this paper would be to expand the sample of countries to assess the effectiveness of the unprecedented fiscal stimuli adopted in response to the record-breaking COVID-19 recession (Auerbach, Gorodnichenko, McCrory, & Murphy, 2021; Hinterlang, Moyen, Röhe, & Stähler, 2021) and, for the Spanish case, to expand the research to wider categories of public expenditures and revenues using data on budget implementation from the General Comptroller of the State Administration (IGAE). Another natural extension of this paper would be to consider in the analysis the feedback from government debt, since, as pointed out by Favero and Giavazzi (2008) and Afonso and Sousa (2012), it may not be neutral and have an impact on inflation and output. These are items in our future research agenda.

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Conflict of interest

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