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ARTICLE



## Sovereign indebtedness and financial and fiscal conditions

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### ABSTRACT

We empirically assess the magnitudes of sovereign indebtedness responses for a sample of 123 Advanced and Emerging Market Economies, between 1980 and 2018, taking into account the changing characteristics of financial markets, notably the Global and Financial Crisis. Our results show that when the financial conditions are more stressful, for instance, higher yield spreads or a heightened degree of financial stress, fiscal authorities use more actively their primary balance to reduce sovereign indebtedness, which is not the case when financial market conditions are more benign. This is notably true for the case of Emerging Market Economies sovereigns, who most likely then struggle more to fund themselves.

### KEYWORDS

Sovereign indebtedness; panel data; financial stress; global financial crisis; emerging markets

### JEL CLASSIFICATION

C23; G15; H63

## I. Introduction



After the recent Global Financial Crisis (GFC) and in the context of important restrictions to the implementation of fiscal policies, notably in Advanced Economies (AE) and in some Emerging Market Economies (EME), the appraisal of how fiscal authorities adjust to financial developments is quite important.<sup>1</sup> For instance, it is useful to assess whether the track record has been one of the more active (less Ricardian) or more passive fiscal developments in several groups of homogenous economies, which can hint at the future expected reaction from the fiscal authorities.

Moreover, it is true that the level of government indebtedness increased to record levels in the context of the GFC, linked (in a vicious cycle) notably to heightened financial stress in capital markets and to higher sovereign yield spreads demanded by potential investors due to uncertainty reasons. At the same time, the ensuing downgrading of sovereign ratings contributed to the increase in the difficulties of sovereigns' access to capital markets. Global debt reached the record peak of US\$164 trillion in 2016, equivalent to 225% of global GDP (IMF 2018). The

world is now 12% of GDP deeper in debt than the previous peak in 2009.

The existing literature has estimated fiscal policy response functions notably in a cross-country analysis setup. In this context, based on the economic rationale that governments care about fiscal sustainability issues, it is possible to envisage a simple fiscal reaction function in which the primary balance improves to counteract past increases in government debt (Bohn 2008; Ballabriga and Martinez-Mongay 2005; Afonso 2008). In addition, the existence of possible cross-section dependencies, notably given the economic and financial interlinkages in advanced (emerging market) economies, capital markets integration, common monetary policy for the euro area countries, has been scarcely addressed within this framework.

Against this background, we empirically assess the magnitudes of sovereign indebtedness responses for sovereign indebtedness for a sample of 123 AE and EME, between 1980 and 2018, taking into account the changing characteristics of the financial markets, notably the GFC. This analysis is then in the vein of the FTPL discussion, where fiscal policy may have a relevant role, at least as important as monetary policy, in determining the price level.<sup>2</sup>

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<sup>1</sup>Some researchers have examined financial sector and crisis-related determinants of sovereign bond spreads (see, e.g. Ebnor (2009) and Dailami, Masson, and Padou (2008)).

<sup>2</sup>See Leeper (1991), Sims (1994) and Woodford (1995).

## II. Empirical methodology

We set up a sovereign debt reaction function (see Canzoneri, Cumby, and Diba 2001; Afonso 2008; Bohn 2008) to assess whether the primary budget balance negatively affects government liabilities. We can estimate the following relationship for country  $i$  and time  $t$ :

$$\Delta B_{it} = \gamma \Delta s_{it-1} + \varphi \Delta B_{it-1} + \beta \Delta z_{it} + \Delta u_{it}. \quad (1)$$

Equation (1) is compatible with the standard budget deficit and debt dynamics formulation, where government debt ( $B$ ) changes due notably to the primary balance ( $s$ ). When  $\gamma < 0$ , most likely the government uses budget surpluses to reduce outstanding government debt. In addition, the output gap ( $z$ ) – the difference between the actual output and potential output (expressed as percentage of potential) – controls for the reaction of debt to the business cycle.  $u_{it}$  is a standard white noise disturbance. The option of using first differences is to avoid potential stationarity issues, an approach followed for instance by Afonso (2008) and Canzoneri, Cumby, and Diba (2001).

We begin by estimating (1) with a pooled OLS estimator (augmented with country and time effects included to control, respectively, for all time-invariant differences across countries – such as geographical characteristics – and for global shocks – such as shifts in oil prices or the global business cycle). The first-differenced equation should take care of stationarity issues, however, it introduces a correlation between the differenced lagged dependent variable and the differenced error term, hence, the use of instruments is required. Consistent estimates can be obtained employing two-stage least squares (TSLS) estimator and relying on instrumental variables (IV) which are correlated with  $\Delta s_{it-1}(\Delta B_{it-1})$  and orthogonal to  $\Delta v_{it}(\Delta u_{it})$ . Indeed, lagged values  $\Delta s_{it-2}$  and  $B_{it-2}$  satisfy these assumptions and can be used as IV for the first-differenced equation (1). To address potential endogeneity concerns, we also rely on a system GMM estimator (Arellano and Bover, 1995). For robustness purposes, other (more recent) estimators that are

arguably preferable since they explicitly deal with cross-sectional dependencies, are also employed. First, we re-run (1) with a panel estimation allowing for Driscoll and Kraay (1998) robust standard errors. Then, we use the Mean Group (MG) estimator (Pesaran and Smith 1995). In addition, we rely on the Common Correlated Effects Pooled estimator that accounts for the presence of unobserved common factors. In its heterogeneous version, the Common Correlated Effects Mean Group (CCEMG), the presence of unobserved common factors is achieved by construction and the estimates are obtained as averages of the individual estimates (Pesaran 2006). Yet another recent approach is due to Eberhard and Teal (2011), termed Augmented Mean Group (AMG) estimator, and it accounts for cross-sectional dependence by including of a ‘common dynamic process’.

As far as data are concerned, we use annual data for 123 countries over 39 years that is, focusing on the period 1980–2018. The fiscal data comes from the IMF’s Government Finance Statistics database. In addition, we use the output gap to control for business cycle fluctuations. The fiscal data comes from the IMF’s Government Finance Statistics database. Despite substantial progress in the estimation methodologies to calculate potential output, there is still not a widely accepted approach in the profession. Researchers adopt two alternative approaches to estimate potential GDP (Borio, Disyatat, and Juselius 2013): i) there are univariate statistical approaches, which usually consist of filtering out the trend component from the cyclical one; ii) there are the structural approaches, which derive the estimates directly from the theoretical structure of a model. In the present paper, we opt for the first approach, that is, the output gap is computed using the Hodrick-Prescott filter (as standard practice in the literature).<sup>3</sup>

As far as panel stationarity is concerned, results of first (Im, Pesaran, and Shin 1997) and second-generation (Pesaran 2007) panel integration tests are available upon request for reasons of parsimony. Essentially, we can accept most conservatively that

<sup>3</sup>Alternatively, we also employed the IMF’s WEO output gap which yielded qualitatively similar results, even at the cost of a smaller number of observations. In fact, the bivariate correlation between the common set of WEO and HP-generated output gaps was 85% in our sample. The reason why the WEO output gap was not used as the baseline relates to the fact that these estimates are problematic in a cross-country analysis as they are based on methodologies that vary by country desk. As such, differences in gap estimates across countries are also due to the different methodologies used, rather than differences in economic fundamentals. In addition, by applying a filter we maximize the total number of observations available in a consistent and uniform manner.

non-stationarity cannot be ruled out in the main variables of interest in levels.

### III. Empirical analysis

In Table 1 we report our baseline results. It is possible to see that, indeed, better fiscal positions (higher primary balances) translate into lower sovereign debt ratios. In addition, such reaction is statistically less significant after the GFC. This can be interpreted as a bigger part of the increase in sovereign debt being at that time probably more related to the so-called stock-flow adjustments. These in many cases stemmed from the materialization of contingent liabilities that countries had to absorb in their public accounts. In addition, it seems that the coefficient of changes of primary balances is larger (in absolute value) in the subsample of AEs relative to EMEs.

In Table 2 we account for financial conditions present in the markets and rely on the system GMM estimator (results using other estimators available upon request). Note that due to data availability constraints Tables 2 and 3 are estimated with data until 2014.<sup>4</sup> In other words, we split the sample considering the cases above and below the subsample median (that is, either the subsample of

AE or EME) of the Financial Stress Indicator (FSI) and of sovereign bond spreads vis-à-vis the USA.<sup>5</sup> It is important to notice that when financial conditions are more stressful, governments more actively use primary balances to curb down sovereign indebtedness. This is notably true in the EMEs sub-sample, which is not the case when financial market conditions are more benign, where almost no statistically significant effect can be uncovered between the primary balance and the debt ratio. In the case of AEs, the Ricardian behaviour is present in both cases.

Moreover, the magnitude the response of debt to higher primary balances, in dire financial conditions, is also higher and more statistically significant in the cases of high spreads, for the EME and AE subsamples, which may imply that sovereigns struggle more to finance themselves in capital markets in those periods. Spreads are a measure of a country's overall risk premium, stemming from market, credit, liquidity, and other risks. EMEs during times of hardship are typically characterized by a higher degree of uncertainty (relative to AEs) leading to higher prices demanded on their sovereigns. This finding is consistent with the view that crisis periods adversely affect the ability of sovereign issuers to service their debt, which is reflected

**Table 1.** Baseline results (1980–2018).

Estimator	(1) OLS	(2) IV	(3) GMM	(4) GMM	(5) GMM	(6) GMM	(7) GMM
Sample	all	all	all	AE	EME	all	all
Time Spain	all	all	all	all	all	Before GFC	After GFC
L.change in debt	0.204*** (0.035)	0.217*** (0.041)	0.223*** (0.066)	0.386*** (0.088)	0.193** (0.074)	0.219*** (0.070)	0.238*** (0.089)
L.change in primary balance	-0.091*** (0.019)	-0.094*** (0.020)	-0.027* (0.015)	-0.253*** (0.113)	-0.028* (0.015)	-0.023** (0.009)	-0.107 (0.118)
change in output gap	-0.003* (0.002)	-0.004 (0.003)	-0.004** (0.002)	-0.179 (0.188)	-0.004* (0.002)	-0.003** (0.001)	-0.022 (0.021)
Observations	2,799	2,675	2,799	943	1,853	1,851	1,894
Number of countries	123	123	123	36	87	123	123
R-squared	0.273	0.111					
Hansen P-value			0.56	0.71	0.87	0.42	0.72
AR2 P-value			0.126	0.203	0.182	0.118	0.261
AR1 P-value			0.012	0.002	0.003	0.001	0.008

'GFC' denotes Global Financial Crisis (corresponding to 2007/08). 'L' denotes the lagged variable. Robust standard errors in parenthesis clustered at the country level. The Hansen test evaluates the validity of the instrument set, i.e. tests for over-identifying restrictions. AR(1) and AR(2) are the Arellano–Bond autocorrelation tests of first and second order (the null is no autocorrelation), respectively. Time and country fixed effects were included, but are not reported. Also, a constant term has been estimated but it is not reported for reasons of parsimony. \*, \*\*, \*\*\* denote statistical significant at the 10, 5 and 1% level, respectively.

<sup>4</sup>The FSI data are only available until 2014. We use the spreads data ending also in 2014 for comparability purposes.

<sup>5</sup>The FSI variable was retrieved from Balakrishnan et al. (2009) extended to 2014. This index represents an important improvement vis-à-vis zero-one binary variables, as it measures the intensity of stress and it is not ambiguous regarding 'near-miss' events. Moreover, it covers both abrupt rises in risk and uncertainty, concerns about the health of the financial sector, large swings in asset prices and sudden drops in liquidity. Bond yields come from Datastream and Bloomberg and the spread was computed vis-à-vis the US benchmark.

Table 2. Accounting for financial conditions, AE vs EME (1980–2014).

Estimator	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	GMM	AE	GMM	AE	GMM	AE	GMM	AE	GMM	EME	GMM	EME	GMM	EME	GMM	EME
Sample	Low FSI		High FSI		Low Spreads		High Spreads		Low FSI		High FSI		Low Spreads		High Spreads	
L.change in debt	0.361** (0.167)		0.272*** (0.077)		0.390*** (0.098)		0.371*** (0.132)		0.331** (0.119)		0.174 (0.127)		-0.021 (0.127)		0.170 (0.131)	
L.change in primary balance	-0.222** (0.083)		-0.283** (0.105)		-0.134 (0.101)		-0.241*** (0.082)		-0.241 (0.478)		-0.441*** (0.149)		-0.464 (0.425)		-0.412*** (0.122)	
change in output gap	-44.210* (21.565)		-12.582 (12.374)		-12.933 (16.899)		-6.693 (18.121)		-10.032 (55.276)		-1.474 (15.907)		-18.782 (38.457)		-1.151 (15.816)	
Observations	287		529		397		419		136		632		130		638	
Number of countries	25		35		33		30		20		48		17		46	
Hansen P-value	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
AR2 P-value	0.76		0.99		0.13		0.25		0.76		0.18		0.11		0.60	
AR1 P-value	0.09		0.01		0.02		0.01		0.02		0.07		0.06		0.03	

'L' denotes the lagged variable. Robust standard errors in parenthesis clustered at the country level. The Hansen test evaluates the validity of the instrument set, i.e. tests for over-identifying restrictions. AR(1) and AR(2) are the Arellano-Bond autocorrelation tests of first and second order (the null is no autocorrelation), respectively. Time and country fixed effects were included, but are not reported. Also, a constant term has been estimated but it is not reported for reasons of parsimony. \*, \*\*, \*\*\* denote statistical significant at the 10, 5 and 1% level, respectively.

in the premium on their bond yields.<sup>6</sup> This conclusion is also valid for the case when the full country sample is used instead (see Table 3).

Finally, we re-estimated the baseline analysis using alternative estimators as a robustness check. In addition, we also split the sample by geographical regions (Europe, Western Hemisphere, Africa, and Asia and Middle East) and the time span by decade.

Table 4 summarizes the signs (positive or negative) of the obtained estimated coefficients of the change in primary balances (and also whether the obtained coefficients were statistically significant). We get the confirmation of the estimated negative coefficient for the cases of Europe and Western Hemisphere, while there is no statistically supported reaction in the case of the African, and Asian and Middle Eastern country sub-samples. Moreover, we can observe that, while in the sub-period 2000–2010 there is a statistically significant effect of the primary balance in reducing sovereign indebtedness, that effect is no longer significant in the period of the crisis (2010–2014), confirming our baseline results (recall Table 1).

#### IV. Conclusions

We assessed the magnitudes of sovereign indebtedness responses for sovereign indebtedness for a sample of AE and EME, between 1980 and 2018.

We found that when the financial conditions are more stressful, for instance, higher yield spreads or higher financial stress, fiscal authorities use more actively the primary balance to reduce sovereign indebtedness, which is not the case when financial market conditions are more benign. This is notably true for the case of EMEs.

Policy implications are twofold: i) adverse financial conditions put more pressure onto fiscal authorities that make an effort to keep their debts on track more actively; that is, stringent financial conditions act as a disciplinary mechanism; ii) after the 2008–10 GFC it seems plausible that other (key) factors, over and beyond that coming from budgetary imbalances, end up showing up in the stock of sovereign debt.

<sup>6</sup>Bellas, Papaionannou, and Petrova (2010) findings indicate that financial sector vulnerabilities appear to be a crucial factor in explaining movements in spreads in EMEs.

**Table 3.** Accounting for financial conditions, whole sample (1980–2014).

Specification	(1)	(2)	(3)	(4)
Estimator	GMM	GMM	GMM	GMM
Sample	all	all	all	all
Criterion	Low FSI	High FSI	Low Spreads	High Spreads
L.change in debt	0.412*** (0.133)	0.154** (0.063)	0.332*** (0.086)	0.173** (0.072)
L.change in primary balance	-0.161* (0.091)	-0.390*** (0.096)	-0.172* (0.085)	-0.364*** (0.128)
change in output gap	-27.723 (18.832)	-7.151 (11.611)	-7.970 (12.997)	-5.702 (12.385)
Observations	390	1,365	414	948
Number of countries	45	95	37	77
Hansen P-value	1.00	1.00	1.00	1.00
AR2 P-value	0.99	0.88	0.14	0.69
AR1 P-value	0.03	0.00	0.02	0.00

'L' denotes the lagged variable. Robust standard errors in parenthesis clustered at the country level. The Hansen test evaluates the validity of the instrument set, i.e. tests for over-identifying restrictions. AR(1) and AR(2) are the Arellano–Bond autocorrelation tests of first and second order (the null is no autocorrelation), respectively. Time and country fixed effects were included, but are not reported. Also, a constant term has been estimated but it is not reported for reasons of parsimony. \*, \*\*, \*\*\* denote statistical significant at the 10, 5 and 1% level, respectively.

**Table 4.** Robustness checks and sensitivity (1980–2018).

Effect of change in debt on ...	Driscoll-Kraay	CCEMG	MG	AMG
<i>Robustness Estimators</i>				
L.change in primary balance ( <b>controlling for change in output gap</b> )	-0.096***	-0.276***	-0.193***	-0.287***
<i>Geographical Regions (with GMM)</i>				
L.change in primary balance ( <b>controlling for change in output gap</b> )	Europe	Western Hemisphere	Africa	Asia and Middle East
<i>Time split (with GMM)</i>				
L.change in primary balance ( <b>controlling for change in output gap</b> )	1980–1990	1990–2000	2000–2010	2010–2018
	-0.256**	-0.017**	-0.185**	-0.140

Estimation of (1). 'L' denotes the lagged variable. For further details on the estimators refer to the main text. \*, \*\*, \*\*\* denote statistical significant at the 10, 5 and 1% level, respectively.

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