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Assessing the Growth-Enhancing Effect of State Contingent Debt Instruments

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Abstract. This paper assesses the growth-enhancing effect of State Contingent Debt Instruments (SCDIs) and uses a panel data set of 7 countries from 1991 to 2021. Exploring this relationship empirically for the first time contributes to understanding SCDIs' impact on debt management and growth promotion. SCDIs' present value exerts a pro-cyclical effect and alleviates the debt burden, significantly promoting Gross Domestic Product (GDP) growth and improving fiscal balance. The share of SCDI on external debt shows a positive and significant impact on economic growth, suggesting that linking the principal to economic performance can enhance growth. The decrease in SCDIs' present value increases the fiscal surplus, implying that SCDIs contribute to improving fiscal balance.

Keywords : State Contingent Debt Instruments, Fiscal Balance, Present Value, Public debt, Debt burden

JEL CODE : C26, C23, E44, E62, F34, H6

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1 Introduction

A high debt burden can significantly impact various budgetary aggregates, including fiscal finances. This concern becomes more pronounced when debt ratios are projected to increase again and continue rising by about 1 percentage points per year over the medium term until 2028.[1] Given this outlook, exploring strategies to ensure debt sustainability becomes interesting.
Debt sustainability refers to the ability of a government to service its debt while preserving its fiscal balance (Cristina et al. (2011)).[2] It could be estimated by the Debt-to-GDP ratio, which measures the debt burden relative to the size of the economy, and by the debt service ratio which reckons the share of revenue that the borrowers, here the government, will dedicate to debt obligations, it includes interest and principal payments.
One way to promote debt sustainability would be to alleviate the Debt-to-GDP ratio or to improve debt management, namely, to ease the ability of a government to service its debt. The latter is a core aspect of fiscal space (Kose et al. (2022)) and refers to the budgetary space to create and allocate funding for different purposes without deteriorating the sustainability of government (Heller (2005)). Fiscal balance is one channel through which the debt burden affects the government budget and its ability to implement growth-enhancing reforms. It is simultaneously a signal of fiscal sustainability and public investment leverage. Thus, promoting and improving fiscal balance could enhance growth (Easterly and Rebelo (1993)).

In this context, State Contingent Debt Instruments (SCDIs) emerge as a potential alternative or complement to traditional sovereign debt instruments. They are designed to link debt service to the borrower's ability to pay, using a state variable as an anchor. SCDIs limit the increase in the debt ratio in bad times, thus decreasing the probability that the debt becomes unsustainable. SCDIs' debt service follows, within a narrower range, their country's economic performance. As supported by Cohen et al. (2020), SCDIs allow countries to suspend or reduce payments during an economic slowdown. This design aims to improve fiscal balance and reduce incentives for pro-cyclical policies, which lead to deeper economic slowdowns. When a contraction of the economy occurs, SCDIs debt payments will be lower than those of a plain vanilla bond. The flexibility of SCDIs payments helps to maintain a sustainable Debt-to-GDP ratio and avoid costly adjustments in the government fiscal balance. In the same way, in times of economic expansion, the country will pay more than it would have without indexation. This payment scheme helps to keep the debt-to-GDP ratio on a sustainable path.
Despite the attractive features of SCDIs, their growth risk affects their risk premium and can reduce their positive effect (Griffith-Jones and Sharma (2006)). The risk premium may offset the advantages offered by SCDIs specific design. If investors perceive a higher risk associated with SCDIs, it might drive up their prices because their returns depend on the country's economic performance. Therefore, assessing the growth potential of SCDIs could help alleviate implementation challenges and uncertainty towards their return and ease their acceptance.

By estimating the growth-enhancing effect of SCDIs, policymakers and investors can gain insights into these instruments' efficiency and potential limits.
The study aims to assess the growth-enhancing effect of SCDIs and draws upon the research conducted by Johansson (2010), who investigates the impact of debt relief on growth. Until now, no empirical research has been conducted on the growth-enhancing effect of SCDIs. The objective would be to assess the effect of SCDIs on growth, investment, and fiscal balance.

[1] As highlighted in the World Economic Outlook report of April 2023.
[2] Debt sustainability does not only refer to government debt situation, but the definition here will be restricted to our area of interest

The contribution of this paper is twofold. Firstly, it provides a new and accurate database on SCDIs, addressing the current gap in empirical research. No databases gather all relevant SCDI variables, including coupon rates, principal amounts, bid prices, and yields.[3] The creation of such a database relies on a deep investigation of countries that issued SCDI and their standardized identifier code that identifies all securities (ISIN code).
Secondly, this paper provides empirical results that shed light on the performance of SCDIs in promoting economic growth. Thanks to the database created, empirical investigation is possible, and it fills the gap in the current literature that provides only simulations and theoretical results on the subject. By examining the actual growth outcomes of countries implementing SCDIs, this paper will provide insights into the potential of these instruments to generate positive growth effects. Results show that SCDIs' present value exerts a pro-cyclical effect and alleviates the debt burden, further promoting significant GDP growth and fiscal balance. The share of SCDIs on external debt shows a positive and significant impact on growth, suggesting that linking the principal to economic performance can enhance growth. The decrease in SCDIs' present value leads to an increase in fiscal balance.
Using an Instrumental Variable Regression and a panel data regression on seven countries that used SCDI from 1991 to 2021, results find that SCDIs' present and market value harm fiscal space. Furthermore, most specifications show a positive and significant effect of SCDIs share on growth and investment.

The paper proceeds as follows. Section 2 discusses the literature review on SCDIs, and Section 3 presents the theoretical framework and outlines testable hypotheses. Section 4 introduces the model, data, and estimation methodology; Section 5 presents the estimation results, and Section 6 tests the robustness of the results. Section 7 concludes.

[3]The only existing database is the one of Pina (2020), which provides information on SCDI features.

2 Literature Review

One motivation for implementing SCDIs is to provide financial products that alleviate the public debt burden and promote growth. The first canonical model was presented in Shiller (1994), where both the coupon and the principal were tied to the level of nominal GDP. It aimed to handle risks associated with shocks in crucial economic indicators to improve stability and economic resilience. The objective of creating instruments that alleviate the debt burden is also due to the negative effect of debt on growth. Indeed, numerous studies have shown that a high level of debt impedes growth.
Woo and Kumar (2010) and Eberhardt and Presbitero (2015) have found a negative relationship between the initial Debt-to-GDP ratio and annual per capita GDP growth. Similarly, a high level of public debt is negatively correlated with economic growth (del Carmen Ramos-Herrera and Sosvilla-Rivero (2017)). According to Kaure (1994), high debt servicing could lead to a debt trap, which decreases the incentive to implement long-term growth reforms.[4] A high debt-to-GDP ratio is also linked to a higher probability of default (Ghulam and Derber (2018)). To prevent sovereign default, a comprehensive debt restructuring framework that ensures a faster return to growth is needed (Jensen (2022)).

Finding an instrument to allow debt relief could alleviate the debt burden. The debt overhang theory supports that reducing the debt stock can promote growth by providing incentives to invest and reform (Krugman (1988)). Empirical studies have also examined the effects of debt relief on economic performance. Debt relief can provide debtors with financial relief, helping them to restore their economic stability and support economic growth(Dijkstra and Hermes (2001); Sichula (2012)).

State Contingent Debt Instruments can be considered a form of debt relief. They are often used within the debt restructuring framework to increase fiscal space and free up resources (Griffith-Jones and Sharma (2006)). Even though most results favor the implementation, they remain based on theoretical and simulation results without data. Indeed, calibrated models such as Barr et al. (2014) demonstrate that indexing debt to the GDP growth rate can result in significant welfare gains. Guerson (2021) also shows, through a theoretical model, that a state-contingent contract is optimal for the sovereign. Based on a calibrated model Demertzis and Zenios (2018) support that SCDIs could protect the euro area zone from future debt crises.[5] Simulation studies conducted by financial institutions have highlighted the potential role of SCDIs in improving sovereign debt restructurings (Cohen et al. (2020)). Those studies are conducted on a comprehensive debt restructuring framework, which could lead to biased estimates when measuring the effect of SCDIs. Furthermore, the significant heterogeneity in the feature of SCDIs has led to a lack of empirical studies exploring the impact of this heterogeneity on their performance. Most studies focus on GDP-indexed bonds, such as Borensztein and Panizza (2009). They found that this instrument aims to maintain the Debt-to-GDP ratio at a sustainable level and mitigate the risk of default. By linking debt service to economic fluctuations, GDP-indexed bonds enable governments to implement counter-cyclical policies and promote debt sustainability measures.
Most studies support that these instruments reduce default risk, prevent debt restructuring, and stabilize the Debt-to-GDP ratio. They also create fiscal space for governments to implement counter-cyclical policies, and their implementation serves as an indirect incentive for growth-enhancing reforms (Cabrillac et al. (2016)). Despite potential advantages, concerns regarding GDP-indexed bonds persist. They include the accuracy of GDP data, bond liquidity, and pricing mechanisms (Griffith-Jones and Sharma (2006)). One challenge lies in pricing, particularly

[4] The study was conducted in developing countries. They also found that high debt servicing increases the likelihood of a debt crisis.

[5] They show that the marked-based insurance provided by SCDIs could reduce the crisis likelihood.

the risk premium associated with debt service repayments, which can be high due to uncertainties surrounding a country's growth potential. Convincing investors of solid growth prospects is crucial to achieving SCDI at a lower cost.

3 Theoretical Framework

3.1 SCDIs and fiscal space

State contingent debt instruments (SCDIs) aimed at smoothing debt service by following the economic performance of a country (Griffith-Jones and Sharma (2006)). By improving fiscal balance, they reduce the probability of snowball effects and the usage of pro-cyclical policies.

According to Romer and Romer (2019), a lower Debt-to-GDP ratio enables countries to face financial distress better, thanks to their available fiscal room.[6] The debt stock can be alleviated during recessions with an SCDIs design where the principal is anchored to a state variable such as GDP, nominal wages, or the consumer price index. It keeps the Debt-to-GDP ratio sustainable and prevents an explosive debt path.
Heller (2005) provides evidence that debt relief can impact investment and growth by creating fiscal space. One of the objectives of SCDIs is to enhance the efficiency of fiscal policy. It can be achieved by freeing up resources through debt relief measures during economic slowdowns.[7] Ghosh et al. (2013) also compare short-term debt to GDP-linked bonds and found that all things being equal, GDP-linked bonds can help boost fiscal space better.

SCDIs should improve fiscal balance and prevent pro-cyclical policies.

3.2 SCDIs and growth-enhancing effect

Debt restructuring and introducing bonds tied to state variables can create incentives to implement growth-enhancing reforms.
Governments must offer investors attractive returns on their SCDIs, which implies solid growth proposals (Griffith-Jones and Sharma (2006)). Indeed, investors could be refrained from investing in long-maturity SCDIs if only short-term growth strategies were implemented.[8] Therefore, by linking bond issuance to state variables, governments are encouraged to prioritize sustainable and long-term growth strategies, reassuring investors.

The introduction of SCDIs, creating incentives for long-term growth, can positively affect GDP.

3.3 SCDIs and investment

An increase in the public Debt-to-GDP ratio has significant effect on investment. Mendonça and Machado (2013) demonstrate that the negative effect of a high sovereign Debt-to-GDP ratio on investment is strong.[9] This adverse impact is more pronounced in the case of public investment, as highlighted by Kostarakos (2021) in the context of EU countries.
Alleviating the debt burden with better debt services management can boost investment. *SCDIs*

[6] The subsequent fiscal room created by a reduction in the debt-to-GDP can be used to conduct expansionary fiscal policies, leading to less severe aftermaths.

[7] Fiscal policy could be improved by an increase in available resources, which allows to increase spending or reduce taxes without deteriorating fiscal sustainability,(Kose et al. (2018)).

[8] Carnot and Sumner (2017) shows that reforms of short-term or growth-deteriorating could reduce the incentive to invest.

[9] The study was conducted after the Global Financial Crisis.

have the potential to enhance investment by reducing the debt burden and creating a favorable climate.

3.4 The SCDIs and country's & bond's characteristic

The economic performance of SCDIs is influenced by the bonds' terms and conditions and the issuing country's credibility. As highlighted by Koeda (2006), the effectiveness of debt relief depends on the economic, demographic, and financial situation.
Carnot and Sumner (2017) highlights several issues with SCDIs payments calculation, such as misreporting of GDP data, inaccuracies in measuring key variables, data revisions, and methodologies modifications. A credible and strong institution that guarantees the payment calculation's reliability is essential for the instruments' efficiency and consistency.

Lastly, the degree of take-up or participation in SCDIs can contribute to heterogeneous results. *SCDIs effects could be affected by country's characteristics*

4 Empirical Framework

4.1 Dataset

The dataset used in this study consists of macroeconomic variables from the World Bank between 1991 and 2021.[10] This study focuses on seven countries utilizing SCDIs. To identify these countries the work of Pina (2020) and Igan et al. (2021) is used. They provide ISIN (International Securities Identification Numbers) codes that allow for retrieving precise data on bonds.[11]. To ensure homogeneity in the dataset, only countries that have utilized bonds as SCDIs were selected, while loans were excluded. Given the novelty of these instruments, the observed countries exhibit significant heterogeneity in terms of both country and bond characteristics.[12] Countries included in the dataset are Argentina, Hungary, India, Italy, Nigeria, Ukraine, and Uruguay. The data selected for each country comes from Reuters on the amount of SCDI issued, the yield, the bid price, the coupon, the frequency, and the maturity of each bond.
The work of Johansson (2010) influences the choice to use present value and market value variables on debt relief, given that SCDI can be seen as an instrument that reduces the debt burden.

4.1.1 SCDI Value Computation

Bond Present Value represents the sum of bond expected future cash flows (Dikhanov (2004)). It is calculated by discounting the bond service cash flow by an appropriate discount rate, which considers the time value of money and the bond's associated risk:
Bond present value (Caks (1977)) :

$$\sum_{t=1}^{N} \frac{C}{1+y}^{t} + \frac{P}{1+y}^{N} \tag{1}$$

C represents the coupon, P is the principal, y is the yield to maturity (YTM), and t is the years until maturity.
This variable aims to estimate the economic impact of debt obligations and gives insight into

[10] Database: World Development Indicators, license type: CC BY-4.0; see the detail in the annex. The selection of explanatory variables follows the specifications outlined by Barro (1991) to compute GDP.
[11] ISIN codes are unique alphanumeric codes used to identify specific securities such as stocks, bonds, and other financial instruments
[12] A detailed presentation of each SCDI scheme is conducted in the Annex.

debt sustainability. t could measure the variation in debt burden since a reduction in the bond's present value implies a reduction in its expected future value. In most theoretical models, the discount applied refers to the opportunity cost of capital, which is its rate of return (Igan et al. (2021)). In an empirical setting, using the YTM as a proxy for the discount rate is common.[13] The YTM represents the total return expected if the bond is held until maturity; it includes both the interest rate and the risk. In Poghosyan (2014), they are found to be sensitive to Debt-to-GDP ratio and potential growth.[14]
The market value of SCDI is also computed to further capture the effect of market perceptions and risk on SCDI.

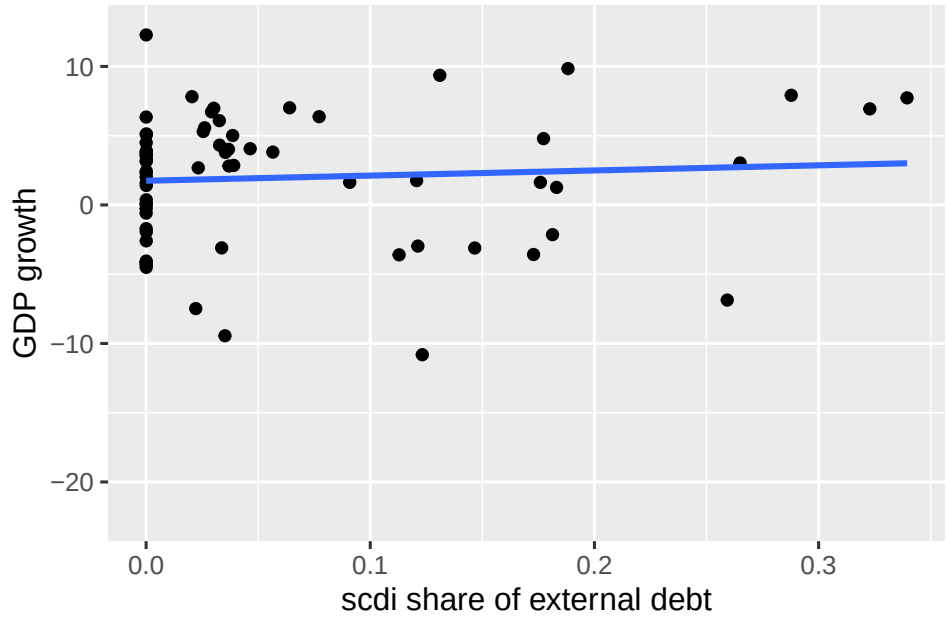
Bond Market Value refers to the current market price at which a bond can be bought or sold on the secondary market. It captures factors of market perceptions towards the country or the financial product.[15] When computing the bond market value, the bid price is used instead of the ask price because it reflects the demand side of the market and represents the investor's willingness to pay.
Bond Market value :

$$Principal\_Amount * Bid\_Price \tag{2}$$

4.2 Descriptive Statistics

First, a linear regression of SCDI on GDP is plotted. The graphic shows a positive relationship between GDP and the share of SCDI on the total amount of external debt stocks.[16] Considering that the principal of SCDIs is revised annually based on the chosen anchor, the share is likely to be driven by SCDIs; thus, the positive relationship could be due to SCDIs relief effect.

Figure 1: SCDI & GDP



Note: The GDP growth is a percentage of annual growth at market prices in domestic currency. The variable of SCDI is a share of the external debt stock. Both variable exerts a positive relationship

Aa plot is conducted to assess the effects of maturity and SCDI features. Indeed Kim and

[13] In Caks (1977), they use the YTM to compute the present value.
[14] The study was conducted on 22 advanced economies between 1980 and 2010.
[15] It includes prevailing interest rates, credit risk, and market demand.
[16] A shared variable is preferred instead of an absolute value because of the restricted size that SCDI represents on the whole macroeconomics aggregates.

Ostry (2020) compare short-term debt to GDP-linked bonds and found that the latter can better help to boost fiscal space for a given path of primary balance. Thus, SCDIs are confronted with short-term public debt in the same plot. The share of long-term public debt on external debt is added since longer maturities can also improve fiscal balance.
The share of long-term public debt presents a significant and positive association with the government's total expenditure. Indeed, higher government expenditure necessitates borrowing through long-term debt instruments to finance fiscal obligations over an extended period.
Additionally, the share of SCDIs and short-term public debt exhibit a similar positive trend with government expenditure. SCDIs share has a stronger relationship than short-term public debt share. It indicates that the SCDIs share is more influenced by changes in government expenditure than the share of short-term debt.
The strong relationship SCDIs share with government expenditure suggests that tying the principal of the SCDI to economic performance may enhance the sensitivity of this debt instrument to changes with government expenditure. It could be attributed to the fact that SCDIs principal is revised annually based on the chosen anchor, making it more susceptible to fluctuations than short-term public debt stock.

Figure 2: Debt aggregates & Fiscal balance

Note: Government expenditure is the total of general government expenses in the percentage of GDP. The variable of SCDIs is expressed as a share of external debt stocks. Short-term and long-term public debt is a share of external debt stocks.

4.3 Estimation Method

A Panel Data fixed effects estimation is used to estimate the effect of SCDIs on fiscal balance, GDP growth, and investment. It also provides robust and reliable estimation, controlling for the impact of time-varying independent variables on the dependent variable. **An instrumental Variable Regression** Estimation is used to handle the endogeneity between SCDIs and the state variable while testing the hypothesis from the literature. When conducting regressions to analyze the effect of SCDIs on GDP growth and investment, a significant issue arises regarding

the size of SCDIs bonds compared to other macroeconomic variables. SCDIs account for a small portion of the debt stocks, making it challenging to precisely estimate the direct impact of SCDIs on investment and growth due to the dissimilar magnitudes. However, the existing literature suggests that the marginal effect of SCDIs on fiscal balance could serve as a channel through which SCDI influences growth and investment by providing incentives and resources for long-term growth. Therefore, using the marginal effect of SCDIs on fiscal balance as an instrumental variable allows us to address the size disparity and verify the hypothesis that SCDI could be a growth-enhancing instrument.
The justification for this methodology also lies in econometric arguments, particularly in addressing the endogeneity between SCDIs, growth and investment variables. Given that SCDIs are indexed to state variables such as GDP, consumer price index, oil prices, or nominal wages, there is an endogeneity between GDP and SCDIs debt service. Additionally, depending on the terms and conditions of each SCDIs, either the principal or the coupon could be linked to the state variable, further introducing endogeneity between SCDIs' share of debt and GDP. The strong relationship between GDP and investment leads to the same conclusion regarding the endogeneity between SCDI variables and gross fixed capital formation.
The IV regression model employed is a panel data model, allowing for control of time and country-specific effects.

4.4 Empirical model

The model includes two specifications that will be extended to cover different features of SCDIs. A first set of regression will be conducted on the effect of SCDI on fiscal balance, and second, the focus will be on the effect of SCDI on growth and investment. The latter set of regression will be done through a panel data OLS regression and an instrumental variable regression to assess the marginal effect of SCDI on growth and investment through fiscal balance.

4.4.1 SCDI and Fiscal Balance

On SCDI and fiscal balance, the specification is the following:

$$Y_{it} = \beta SCDI_{it} + \gamma X_{it} + \alpha_t + \mu_i + \epsilon_{it} \tag{3}$$

Where Y_{it} is a measure of fiscal balance, SCDI is the variable of the debt instrument, X_{it} is a set of controls variable, α_t is a time-fixed effect, μ_i is country fixed-effect and ϵ_{it} is a random noise error term.

The bond's present and market value account for the effect of SCDI on fiscal balance. The present value is supposed to be negatively associated with the fiscal balance. Indeed, reducing the SCDIs' present value reduces the debt burden and increases the fiscal balance. The bond market value is also used in the specification to consider the effect of market conditions on SCDI. Since it is composed of the bid price, which is directly linked to market conditions and investors' perceptions, a pro-cyclical effect could be expected between a deterioration of fiscal balance and a decrease in the bid price.

Secondly, comparing SCDIs with long-term public debt offers more precise information on the specific benefits that they can offer besides long maturity. Indeed, according to Kim and Ostry (2020), increasing debt maturity can give the sovereign room for maneuvering, reducing rollover risk. Thus, longer maturity can reduce the vulnerability of debt dynamics to adverse shocks on GDP growth or the fiscal balance.

4.4.2 SCDI and growth & investment

The specification to assess the effect of SCDI on growth and investment is the following:

$$Y_{it} = \beta SCDI_{it} + \gamma X_{it} + \alpha_t + \mu_i + \epsilon_{it} \tag{4}$$

Where Y_{it} is either the GDP growth rate in percentage or the annual growth of the gross fixed capital formation, these two values measure the country's economic performance. SCDIs arre the variable of the debt instrument, X_{it} is a set of controls variable, α_t is a time-fixed effect, μ_i is a country fixed-effect, and ϵ_{it} is an error term.
Even though SCDI schemes are designed to follow countries' economic performance, some features could change their sign or strength. Indeed, the coupon or principal calculation follows countries' terms and conditions, and most repayments are based on the previous year. Consequently, a dissonance can arise if an unexpected crisis or recession occurs and the GDP is reduced while debt service is still based on the previous year.

The specification used for the instrumental regression will be the following:
First stage[17]:

$$Z_{it} = \beta Fisc\_Space_{it} + \alpha_t + \mu_i + \epsilon_{it} \tag{5}$$

The z_{it} will be the share of SCDIs, and $Fisc\_Space$ will be the general government structural balance, representing the budget balance adjusted for cyclical factors and one-off or temporary effects. This indicator is also referenced in Kose et al. (2022) and, after testing for different instruments, appears as the strongest one. α_t is a time fixed-effect, μ_i is country fixed-effect, and ϵ_{it} is a random noise error term.[18]

Then, the second stage will be:

$$Y_{it} = \beta \widehat{Z_{it}} + \beta X_{it} + \alpha_t + \mu_i + \epsilon_{it} \tag{6}$$

The whole specification will follow the one previously presented except that $\beta \widehat{Z_{it}}$ will refer to the fitted values from the first stage. Y_{it} is either the GDP growth rate in percentage or the annual growth rate of the gross fixed capital formation. X_{it} is a set of controls variable, α_t is a country-fixed effect, μ_i is time fixed-effect and ϵ_{it} is a random noise error term.

5 Results

5.1 On fiscal balance

The first table assesses the effect of SCDIs' present and market values on fiscal balance.
The first specification uses short-term and long-term public debt variables and the real interest rate variation. Including different types of debt aims to compare the effect of debt's maturities.[19] Interest rate and lending interest are used to assess the impact of borrowing costs on fiscal balance since the dependent variable considers the interest payments. The logarithm is applied to both variables of interest (SCDIs present value and market value) to address skewness by compressing the range of values and improving the distribution's symmetry.[20] In the first specification, SCDIs' present value appears positive despite being non-significant (p-value:

[17] The table of the first stage is in the Annex

[18] The cyclical component reflects the impact of economic fluctuations on government revenue and expenditure, which can vary depending on the stage of the economic cycle. By adjusting for cyclical effects, the structural balance provides a measure of the underlying fiscal position of the government sector independent of short-term economic conditions.

[19] Following Ghosh et al. (2013), who found a stronger effect of GDP-indexed bonds on fiscal space improvement than short-term debt.

[20] This transformation is useful because data present heterogeneity among SCDI values per country and with other control variables.

0.47798). Their effects remain reduced and even lower than the effect of short-term public debt, which seems counterintuitive. Indeed, as supported by Ghosh et al. (2013), longer maturities can favor fiscal space. Thus, having a coefficient lower for SCDIs, which has a longer maturity than short-term debt, is unexpected. The only significant and positive variable is the logarithm of the long-term public debt, which has a coefficient of 3%.

The second specification, which uses the lending interest rate instead of the interest rate, focuses on the cost of borrowing. Indeed, even though interest rates could affect the fiscal balance, they remain a broader indicator of borrowing costs. Furthermore, using the variable of lending interest accounts for possible multicollinearity bias between the yield and the interest rate.[21]. In the second specification, an increase in the fiscal balance is preceded by a decrease in the lending interest rate. It implies that the improvement in fiscal balance, due to either an increase in revenue or a decrease in expense, is associated with a reduction in borrowing costs. The fact that SCDIs' present value is now negative and significant could assess the efficacy of the SCDIs scheme. Here, the increase in fiscal balance is associated with a decrease in SCDIs' present value. The expected future cash flows required to service the debt decrease, increasing the fiscal balance. Thus, SCDIs' present value decrease by 1% are associated with an increased fiscal balance of 0.272%. Since SCDIs payments are based on the previous year, the reverse causality bias could be excluded, meaning the subsequent reduction in present value allows an improvement of the fiscal balance in the following year. These results could be explained by SCDIs design since either the coupon or the principal is tied to a state variable; it is supposed to be contra-cyclical. Indeed, since the SCDIs scheme is adjusted to economic growth, obligations decrease following a decrease in the anchor variable. The subsequent reduction in debt service improves the fiscal balance by providing flexibility and a fiscal surplus. It helps to smooth the economic cycle and reduce the incentive to implement austerity measures. However, since the yield to maturity is used as a proxy for the discount rate in the computation of SCDIs present value, one could assume that the risk that it captures would have offset the benefits of SCDIs design [22].

To assess the effect of risk and uncertainty on SCDIs, a third specification is conducted with SCDIs market value. It captures market conditions directly since the bid price is used in the market value computation. The coefficient is negative but non-significant. Thus, it implies that despite an improvement in fiscal balance, SCDIs market value decreases, meaning that on the secondary market, SCDIs are valued less even though the fiscal balance is improving. It might arise from a dissonance between economic growth and fiscal balance, as shown by Gavin and Perotti (1997); a fiscal surplus is only sometimes associated with a growth increase.
It could also arise from the uncertainty linked to the bond and its return, as mentioned in Benford et al. (2016) SCDIs and plain vanilla bonds have different sensitivity towards volatility. SCDIs' volatility increases when the state variable is close to the payments threshold, whereas vanilla bonds' volatility is sensitive to the risk of default.

The significant result from this table supports that SCDIs' present value decreases with an increase in fiscal balance. It implies that SCDIs contribute to reducing debt burden when fiscal balance is improved, exerting contra-cyclical dynamics. Findings on SCDIs market value show dissonance between the economic and fiscal balance, giving insights into the complexity of pricing SCDIs in secondary markets.

[21] Multicollinearity arises when the explanatory variable is highly correlated. Here, the present value used the yield to maturity as a discount proxy, which takes into account interest rates

[22] in Benford et al. (2016), they support that SCDIs are likely to bear a stronger risk premium than a plan-vanilla bond because investors will overestimate the likelihood of a negative economic state

Table 1: Effect of SCDI on fiscal balance

	Dependent variable:		
	General government net lending borrowing		
	(OLS 1)	(OLS 2)	(OLS 3)
log SCDI_present_value	0.122	-0.272^{**}	
	(0.161)	(0.109)	
log SCDI_market_value			-0.559
			(0.433)
Short-term debt	0.138	-0.021	0.062
	(0.137)	(0.069)	(0.135)
LT_debt	3.793^{**}	0.360	3.443^{**}
	(1.230)	(0.985)	(1.278)
'Real interest rate (%)'	-0.285		-0.063
	(0.168)		(0.066)
'Lending interest rate (%)'		-0.286^{***}	
		(0.077)	
Observations	27	27	30
R^2	0.828	0.923	0.674
F Statistic	7.229^{**} (df = 4; 6)	17.873^{***} (df = 4; 6)	5.168^{**} (df = 4; 10)

*p<0.1; **p<0.05; ***p<0.01

Notes: Variable of SCDIs present value and SCDIs market value are in logarithm. Short-term debt and long-term debt are a share of external debt stocks. The real interest rate is the adjusted nominal rate by inflation. The lending interest rate is the bank rate banks set to meet short- and medium-term financial needs. An increase by 1% of the real interest increases the General government net lending and borrowing by 0.138%.

5.2 On Growth

The first two regressions of Table 2 use an OLS estimation with country and time-fixed effects. The third regression refers to the instrumental variable regression controlling for the endogeneity between SCDIs and GDP, using the government fiscal balance as an instrument. Here, the log of shares is also used to handle the skewness since most of the shares of SCDIs are near 0.
The first specification shows a positive and significant effect on the share of SCDIs and the annual GDP growth rate. Thus, an increase of 1% of SCDIs share increases the GDP by 0.391%. This result seems coherent since the SCDIs share follows countries' economic performance. Indeed, SCDIs services are designed to follow countries' economic performance within a narrower range. This specification also includes the short-term public debt in percentage of the external debt stocks. Even though insignificant, its effect remains lower than the SCDIs share, which could imply that the longer maturity and the anchor to a state variable have a significant effect on growth.

The second specification uses the same control variables, but the log of SCDIs present value is used instead of SCDIs share. The introduced variable appears significant and negative. The negative coefficients mean that a decrease in SCDIs' present value by 1% is associated with an increase in GDP annual growth rate of 0.442%. The decrease in SCDIs' present value can be considered a decrease in the debt burden, supporting the hypothesis that reducing the debt burden through SCDIs promotes growth. The one-year lag in SCDIs payments reduces the reverse causality bias and allows the confirmation that the reduction in debt burden further promotes growth. Since SCDIs' debt service are designed to follow the state variable variation and countries' ability to pay their debt, a growth increase is expected to increase the SCDIs coupon or principal; if the coefficient appears negative, it might imply that the discount rate alleviates the debt burden. Indeed, the decrease of the discount rate, potentially driven by lower default risk, contributes to reducing the debt burden associated with SCDIs present value.[23]

The third specification addresses a potential issue regarding the magnitude of the SCDIs share coefficient compared to the coefficients of control variables. Indeed, while SCDIs indicators exhibit a significant relationship with economic growth, their effects appear relatively more extensive when compared to other critical macroeconomic aggregates. Factors related to endogeneity bias may influence the magnitude of its impact. If the specification is significant when running the instrumental variable regression, it could mean that SCDIs' share significantly affects GDP through fiscal balance. The structural balance controls the endogeneity between the GDP growth and the SCDIs share.[24] The results of regression present a positive, although non-significant, effect of SCDI on growth through fiscal balance.

In conclusion, SCDIs support the GDP annual growth rate and follow its variation. On the one hand, the share of SCDIs shows a positive and significant impact on growth, suggesting that linking the principal to economic performance can enhance growth. On the other hand, the negative and significant coefficient observed for the present value of SCDIs indicates that SCDIs alleviate the debt burden and exerts a contra-cyclical dynamics.

5.3 On investment

Table 4 aims to estimate the effect of SCDIs on investment. The motivation for having two independent variables, GDP and investment, relies on the fact that SCDIs could affect long-run growth through different mechanisms. If the first investigation (Table 2) is supposed to exert the fact that a more flexible debt burden can enhance growth, using the gross fixed capital

[23] Here since the discount rate is proxied by the Years until Maturity, it is even more sensitive to the risk, or the default likelihood.

[24] The first stage regression is in the annex.

Table 2: Effect of SCDI on GDP

	Dependent variable:		
	GDP annual growth rate		
	(OLS 1)	(OLS 2)	(IV 3)
log SCDI_share	0.391**		3.017
	(0.169)		(11.866)
log SCDI_present_value		−0.442*	
		(0.246)	
Short-term debt	0.195	0.048	
	(0.203)	(0.167)	
Population growth	−3.386	2.100	2.076
	(4.495)	(3.458)	(7.662)
Government net lending/borrowing	0.397	0.134	
	(0.256)	(0.362)	
Rule of Law: Estimate			−6.300
			(7.817)
Export value index	0.012*	0.015*	0.053**
	(0.006)	(0.008)	(0.021)
Lending interest rate (%)	0.036	−0.341	
	(0.054)	(0.224)	
GFCF %	0.146*	0.106*	0.200**
	(0.068)	(0.053)	(0.081)
Real interest rate (%)			0.422***
			(0.157)
Observations	42	52	30
R^2	0.805	0.717	0.813
F Statistic	5.911*** (df = 7; 10)	4.698*** (df = 7; 13)	39.889***

*p<0.1; **p<0.05; ***p<0.01

Notes: GDP annual growth rate is the annual growth rate of GDP, in percentage at market prices in domestic currency. SCDIs share and SCDIs present value are in logarithm. Short-term debt is a share of external debt stocks. Population growth is the exponential growth rate of the midyear population from one year to another in percentage. Government net lending/borrowing is in the percentage of GDP and represents the difference between the revenues and the expenditure of the general government, including the interest rate. The rule of law captures the confidence degree of individuals towards the rule of society, contract quality, property rights, and institutional power. The export value index is the current value of exports in US dollars adjusted with 2000 as the base year. The lending interest rate is the bank rate banks set to meet short- and medium-term financial needs. GFCF is the annual growth rate of gross capital formation in US dollars. The real interest rate is the adjusted nominal rate by inflation. An increase of 1% of the export index increases the GDP annual growth rate by 0.012%.

formation can help to assess whether SCDIs can enhance investment (private and public) by freeing resources.[25]

The result in the first specification shows a positive and significant effect of the log share of SCDIs on investment. Its effect is even stronger than the share of short-term public debt. The variation of the principal of SCDIs enhances investment, even though it is not designed to follow the investment annual growth rate. The explanation could arise from the strong correlation between GDP growth and investment growth.[26] Having the GDP, strongly correlated to investment, as an anchor variable makes the effect of SCDIs share on investment similar to the effect of SCDIs on growth.[27] From this specification, SCDIs design are positively associated with the investment. Two specifications are conducted to investigate whether this growth promotion is due to a direct effect of a reduction in debt burden or an improvement of fiscal balance.

The second specification uses the log of SCDIs present value to measure the impact of expected future cash flows on investment. The coefficient appears as negative although non-significant. A decrease in SCDIs' present value by 1% seems to increase investment by 0.729, meaning that reducing the debt burden through SCDIs design positively affects investment. Here, a potential reverse causality bias could arise. Indeed, increasing investment by boosting government revenues can alleviate the debt burden, reducing the government debt present value and thus SCDIs present value. However, most SCDIs payments computations are based on the previous year, resulting in a one-year lag in SCDIs services. This lag can alleviate the reverse causality bias because the service will be calculated according to past economic performance.

To verify the hypothesis of Heller (2005) on whether SCDIs can promote investment by increasing fiscal balance, a third specification is conducted, using the fiscal balance as an instrument for SCDIs share on debt.[28] The SCDIs share positively affects investment through the fiscal balance, even though it is insignificant. The fact that once instrumented by the fiscal balance, the share of SCDIs is not significant might imply that the promotion of investment (private and public) is not due to the alleviation of fiscal balance but to other underlying factors. The reduction in debt burden could be seen as a signal of a stronger government budget that encourage investment .[29]
The reduction in the debt burden and the subsequent fiscal surplus do not significantly affect investment in growth, suggesting that SCDIs do not significantly enhance public investment. However, the fact that the share of SCDIs still has a positive and significant impact on investment (specification1) could mean that private investment is the most sensitive to SCDIs variation. One possible explanation could be related to the crowding out theory since, here, the reduction in government spending allowed by SCDIs does not create a subsequent increase in the interest rate and thus maintains an available fund for private investment. Another reason for SCDIs' non-significant effect on investment could be linked to savings. Indeed, the free-up of resources provided by SCDIs might have resulted in savings rather than investment. Finally, the fact that SCDIs entered as non-significant in the last specification could be linked to their restricted implementation.[30] The last table will focus on the size of SCDIs to verify if the SCDIs restricted effect is due to their small implementation.

[25] This conclusion relies on Cohen et al. (2020), who found that debt service payments reduce public spending and impede growth

[26] The correlation between GDP annual growth and investment annual growth is 0.6836376.

[27] Only three countries out of 7 choose GDP as the anchor variable, but they represent the largest group

[28] According to Heller (2005), debt relief might affect investment and growth by providing fiscal space.

[29] According to Mendonça and Machado (2013), the debt-to-GDP ratio harms investment.

[30] The descriptive statistics provided in the annex show that SCDIs shares on GDP and external debt account for a small part.

To conclude, this table shows that the log SCDIs share has a positive and significant effect on the annual growth rate of investment. However, the results do not support the hypothesis that reducing the debt burden or promoting fiscal surplus gives significant investment incentives.

Table 3: Effect of SCDI on Investment

	Dependent variable:		
	Gross Fixed Capital Formation annual growth rate		
	(OLS 1)	(OLS 2)	(IV)
log SCDI_share	1.602^{**}		1.493
	(0.634)		(1.088)
log SCDI_present_value		−0.729	
		(1.271)	
Short-term debt	0.742	0.575	5.731
	(0.698)	(0.841)	(4.060)
Population growth	-70.557^{***}	−17.149	22.418
	(18.228)	(18.235)	(15.260)
Export value index	−0.008	0.027	3.401^{**}
	(0.020)	(0.031)	(1.505)
'Lending interest rate (%)'	−0.156	−0.458	-1.754^{***}
	(0.191)	(1.306)	(0.645)
Government expenditure	3.358^{**}	−0.937	−7.846
	(1.366)	(2.339)	(5.474)
Observations	42	52	21
R^2	0.735	0.313	0.937
F Statistic	5.096^{***} (df = 6; 11)	1.064 (df = 6; 14)	14.992^{**}

*p<0.1; **p<0.05; ***p<0.01

Notes: GFCF is the gross fixed capital formation annual growth rate in US dollars. The real interest rate is the adjusted nominal rate by inflation. SCDI share and SCDI present value are in logarithm. Short-term debt is a share of external debt stocks. Population growth is the exponential growth rate in percentage from one year to another. The export value index is the current value of exports in US dollars adjusted with 2000 as the base year. The lending interest rate is the bank rate banks set to meet short- and medium-term financial needs. Government expenditure is the total of general government expenses in the percentage of GDP. An increase of 1% of the export index decreases GFCF's annual growth rate by 0.008%.

5.4 Effect of SCDI take-up degree

One of the remaining issues is linked to the magnitude of the gap between SCDIs and other macroeconomic aggregates. To overcome this, the regression was conducted to assess the effect of a more extensive SCDIs implementation on growth and investment. The regression includes a dummy variable that divides the countries into two groups. The selection is based on the median of the share of SCDIs on long-term debt, such that countries above the median will take the value 1 and countries under will be affected to the value 0.[31] Controls will be added to increase the precision of the panel data estimation strategy. Since the regression will be on growth and investigation, the specification will rely on the growth determinants identified by Barro (1991).

[31] Argentina, Hungary, and Italy are identified as above the median.

Thus, the empirical will be the following :

$$Y_{it} = \beta T_{it} + \gamma X_{it} + \alpha_t + \mu_i + \epsilon_{it} \tag{7}$$

Y_{it} will be either the GDP annual growth in percentage or the Gross fixed Capital Formation annual growth in percentage. T_{it} refers to the dummy variable, which is the group size of a country in the SCDIs. X_{it} refers to control variables, α_t is a country-fixed effect, μ_i is time fixed-effect and ϵ_{it} is a random noise error term. Control variables include a measure of population growth, trade, institutional quality, and fiscal balance. Considering the fact that SCDIs' implementation is likely to be associated with debt restructuring, a measure of financial aid and development assistance is added .
The regression output of Table 14 shows that SCDIs positively affects both dependent variables, but its effects remain restricted since it does not enter significantly in both specifications. It appears that size has no significant effect on GDP and investment growth.

6 Robustness Test

Several robustness tests are conducted to assess the validity of the previous specification. It aims to assess the sensitivity of the previous regression to changes in model specification. The only dependent variable used to focus on the effect of SCDI on growth will be the annual GDP growth.
One of the main issues encountered with the previous specification is the heterogeneity between country and their specific degree of take-up, which can lead to heterogeneous impact and performance of SCDIs.[32] Furthermore, the variable used can capture other variables than the pure effect of SCDIs. Indeed, when using the share of SCDIs on the bond outstanding amount, the variation in the denominator can affect the coefficients and provide biased results. In the same way, the use of the present value can suffer from market perceptions, which can be exogenous to the country's performance or characteristics. To overcome those issues, the first regression includes a binary dummy variable that takes the value of 1 in the years when SCDIs is implemented and 0 otherwise. It allows the estimation of the impact of the introduction of SCDIs on economic growth. It also helps to separate the impact of the SCDIs from other factors that may affect growth and to reduce the heterogeneity issue when estimating performance. In this estimation, a variable of development assistance is also added to account for the fact that most countries that implemented SCDI were under a debt restructuring process .[33] This additional control aims to disentangle the effect of SCDIs from the one of development assistance.
The results show that even though the dummy has a positive effect on GDP growth, it has no significant effect.
The second specification uses the debt service on SCDIs as a variable of interest. Since this variable only considers the coupon and the principal and does not apply a discount, its variation is supposed to vary with GDP without being affected by market conditions. Furthermore, the variable on GFCF is excluded from the model to prevent it from impeding the results due to its high correlation with the GDP annual growth rate.
The debt service enters the model as positive but non-significant.

7 Conclusion

This study has yielded significant findings on the impact of state-contingent debt instruments (SCDIs) on economic growth and fiscal balance. The results reveal that SCDIs' present value

[32] The sample of countries has different features regarding the level of economic development, economic resilience, and economic integration.
[33] It was the case for Argentina, Ukraine, and Uruguay.

exerts a pro-cyclical effect, effectively alleviating the debt burden and notably promoting GDP growth and fiscal balance. The share of SCDIs demonstrates a positive and significant impact on growth, indicating that tying the principal to economic performance can boost growth. Moreover, a decrease in SCDIs' present value increases the fiscal surplus, suggesting that SCDIs play a crucial role in enhancing fiscal balance. However, the results need to confirm that it is through the fiscal balance that SCDIs enhance growth and incentivize investment. Additionally, the results using market value underscore the intricate nature of pricing SCDIs.

The paper has some limitations which could be addressed in future research. Firstly, due to the varying issuance of bonds within the sample countries, the restricted number of observations in the dataset results in missing values for some years. These missing values, endogenous to each country's features and economic conditions, limit the external validity of our model. Future research could enhance the dataset by including International Securities Identification Numbers (ISINs) to create a broader and more diverse dataset. Another limitation is the panel data's heterogeneity, which arises from differences in economic and institutional factors across countries. While increasing the sample size could mitigate this issue, the specific terms and conditions of SCDIs remain country-specific, making exact comparisons challenging. Conducting per-country regressions might address this, but the need for more data for some countries hinders this.

Lastly, the computation of SCDIs' present value using a proxy for the discount rate is limited. The discount rate should ideally consider the interest rate, maturity, and the bond's risk, while the yield captures the bond's current valuation and potential gains or losses.

While this study has provided valuable insights, there is still much to explore in the realm of SCDIs. Future research holds the potential to broaden the understanding of SCDIs beyond debt relief. It could involve creating a more comprehensive dataset to ensure the external validity of findings, delving into the effect of SCDIs on public debt default probability, and examining the influence of market perception on SCDIs. Furthermore, more in-depth research should be undertaken using a more precise discount rate for SCDI's present value. Establishing a standard set of SCDIs could also streamline implementation and enhance effectiveness.

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8 Appendix

8.1 SCDI Scheme

According to IMF (2017), there are three possible benchmark designs for SCDI: the Linker, the Floater, and the Extendible. The Floater and the Extendible are issued in local or foreign currency, whereas the Linker is only issued in local currency.
The Linker is supposed to be tied to the level of nominal GDP or the level of the commodity price index; the Floater could have the same anchor but could also be linked to proxy variables such as trading partners' real GDP growth. The Extendible benchmark is different because it is linked to discrete triggers (large adverse movement in external demand, natural or public health disasters).
Each benchmark design has its adjustment mechanism. Thus for the Linker, the principal is linked to the state variable and can be floored; the coupon varies as a fixed percentage of the principal. In the Floater adjustment design, the coupon is tied to the state variable with a floor and a cap; in this case, the principal is fixed. There is a pre-defined extension of the principal payment by 1 to 3 years for the extendible.
Since each type has its features, they also have specific goals. Thus, the primary purpose of the Linker is to stabilize the debt/GDP during the economic cycle, prevent pro-cyclical policies and reduce default risk. The Floater aims to provide debt service relief during the recession, but since the principal is fixed in this case, it would not affect the debt ratio. Finally, the Extendible one is supposed to provide substantial liquidity support during a crisis. In the following part, a presentation of each SCDI scheme per country will be conducted. The information on payment schemes comes from the terms and conditions attached to each bond issuance and is published by Reuters.

Argentina

Argentina designs its bond such that the holder will receive its payments depending on a certain threshold and specific conditions on the nominal GDP in pesos. The payments will be positive to the coupon holder (CF_t) in year $t+1$ if the following conditions are met (Pernice and Lopez Fagundez (2005)) :

- The average real GDP of year t, Pt is greater than the base GDP of the same year

$$PB_t : (PB_t : CF_t > 0 \Rightarrow P_t \geq PB_t \tag{8}$$

  and if

$$P_t \leq PB_t \Rightarrow CF_t = 0 \tag{9}$$

- Thee actual growth of the average real GDP, gb_t, in a year has to be higher than the base growth, gb_t, (the one corresponding to the predetermined base case GDP):

$$CF_t > 0 \Rightarrow g_t > gb_t \tag{10}$$

  and if

$$g_t < gb_t \Rightarrow CF_t = 0 \tag{11}$$

- 3) The sum of payments to the coupon holders must be smaller than a maximum value (MaxV) of 0.48% of the relevant currency.

$$CF_t > 0 \Rightarrow \sum_{i=1}^{t} CF_i < MaxV \tag{12}$$

If these conditions are met, the amount to be paid in year $t+1$ will be:

$$CF_t = \frac{0.05 * (P_t - PB_t * D_t * u}{FX_t} \tag{13}$$

Where D_t is the GDP price index of year t, u is the currency coefficient unit which transforms into per coupon amount, the total amount to be paid. FX_t convert the cash flow in pesos into the relevant currency.

Hungary

Hungarian SCDIs payments scheme includes the principal and the coupon The principal is computed based on :

$$\frac{HUNGARY\_CONSUMER\_PRICE\_INDEX}{106.1} * PRINCIPAL \tag{14}$$

The Consumer Price Index is divided by 106.1 to adjust the principal amount, and the coupon is set at 4.00. This setting ties the principal with fluctuations in the consumer price index to take into account inflation.

India

India Oil Government Bonds were designed to address the financial difficulties Oil Marketing Companies (OMCs) encountered. They aimed at compensating OMCs for the government-controlled prices at which OMCs have to sell[34] They provide financial support, alleviate their profits losses, and appear as a debt instrument. India Oil Government Bond provides OMCs with financial relief that reduces their losses. The bond is set at a fixed interest rate and represents a promise to pay. At maturity, the Indian Government pays back the principal amount to bondholders. [35] This debt instrument is a means to handle the government fiscal burden and support OMCs without compromising government fiscal finances.

Italy

Italian Government issued SCDIs which involve a bonus applicable to bondholders who acquired the bond at its first issuance and who hold them until maturity. Those investors would receive a bonus payment based on the average annual fluctuations of the Italian nominal GDP.[36] The data used in the computation is from Istat and considers the variation in Italian nominal GDP during the specified period. The bonus is designed to be between 1%

Nigeria

Nigerian Governments issued bond which are referred to as Units and refers to a bond with detachable warrants. Those bonds were tied to the oil price index. The design aimed to revise the payments (named "Rights") following oil price changes. The payments are in US dollars, and investors would earn one Right for each U.S. $1,000 par value of the Bonds they have.[37]

[34] Those prices are lower than market prices.
[35] The repayments could arise with a lump sum or through incremental payments over several years.
[36] The average is computed on the whole year from the bond's first issuance until the maturity year.
[37] It implies that below this threshold bondholders won't benefit from the separate payment adjustment right.

Ukraine

Ukrainian SCDIs (named Second Additional Further GDP-linked Securities) are tied to the GDP growth rate and the payments are made if the GDP is higher than a specific threshold between 2019 and 2038. Payment schemes use a pre-determined reference amount which is based on the real GDP growth and the GDP at current prices. The payments amount is subordinated to the following conditions :

- If the Real GDP Growth Rate is above 3% and not more than 4%, the formula is:
  15% x GDP at Current Prices (for t-1) x (1+GDP Deflator for t) x (Real GDP Growth Rate for t – 3%)

- If the Real GDP Growth Rate is over 4%, the formula is:
  15% x GDP at Current Prices (for t-1) x (1+GDP Deflator for t) x 1% + 40% x GDP at Current Prices (for t-1) x (1+GDP Deflator for t) x (Real GDP Growth Rate for t – 4%)

- The Reference Amount will be nil if the Real GDP Growth Rate is smaller than or equal to 3% or if the GDP at Current Prices is under the specified threshold. Furthermore, for Reference Years from 2019 to 2023, the Reference Amount must be under 1% of GDP at Current Prices for the respective Reference Year.

Uruguay

Uruguay tied SCDIs to nominal wage. The formula of the payments is adjusted with the Unidad Provisional, which is an accurate accounting of nominal wage.

SCDI Scheme Summary

Table 4: SCDI

Country	ISIN	Issuance year	Maturity (years)	Type	Anchor
Argentina	ARARGE03E154	2005	20	Floating	GDP
	US040114GM64				
	XS0501197262				
Hungary	HU0000402169	1999	5	Floating	Prices Index
India	IN0020089010	2008	15	Fixed	Oil Prices
Italy	IT0005415291	2020	10	Variable	GDP
Nigeria	XS0035901601	1992	28	Variable	Oil
Ukraine	XS1303929894	2019	40	Floating	GDP
	US903724AW28				
Uruguay	UYNA00001UP7	2018	7	Floating	Nominal Wage

8.2 Summary Statistics on SCDI

Table 5: Argentina

	SCDI_share	scdi_pib	scdi_extdebt
Min	0.0000	0.02783	0.1129
1st Qu	0.0004	0.02858	0.1310
Median	0.0010	0.02916	0.1773
Mean	92.7189	0.03490	0.1946
3rd Qu	12.0172	0.04496	0.2592
Max	941.2140	0.05514	0.3395
NA's	20	14	14

Table 6: Hungary

	SCDI_share	scdi_pib	scdi_extdebt
Min	0.002204	0.000000	NA
1st Qu	0.002806	0.000526	NA
Median	0.003214	0.000661	NA
Mean	0.003543	0.000550	NaN
3rd Qu	0.004511	0.000713	NA
Max	0.005016	0.000768	NA
NA's	25	23	31

Table 7: India

	SCDI_share	scdi_pib	scdi_extdebt
Min	0.005291	0.001493	0.02046
1st Qu.	0.007557	0.001635	0.02567
Median	0.011246	0.002012	0.03143
Mean	0.015043	0.002105	0.04166
3rd Qu	0.024000	0.002486	0.05401
Max.	0.032443	0.003101	0.09084
NA's	19	17	17

Table 8: Italy

	SCDI_share	scdi_pib	scdi_extdebt
Min	0.01128	0.003653	NA
1st Qu	0.01165	0.003715	NA
Median	0.01201	0.003777	NA
Mean	0.01201	0.003777	NaN
3rd Qu	0.01238	0.003838	NA
Max	.01274	0.003900	NA
NA's	29	29	31

Table 9: Nigeria

	SCDI_share	scdi_pib	scdi_extdebt
Min	0.000000	0e+00	0.0000299
1st Qu	0.000000	0e+00	0.0000576
Median	0.000000	0e+00	0.0000719
Mean	0.000039	1e-07	0.0000762
3rd Qu.	0.000000	1e-07	0.0000880
Max	0.000785	1e-07	0.0001515
NA's	8	2	2

Table 10: Ukraine

	SCDI_share	scdi_pib	scdi_extdebt
Min.	0.000021	0.001242	0.03276
1st Qu	0.000023	0.001265	0.03445
Median	0.000029	0.001291	0.03539
Mean	0.042027	0.001293	0.03569
3rd Qu	0.000080	0.001313	0.03685
Max.	0.293935	0.001358	0.03908
NA's	24	24	24

Table 11: Uruguay

	SCDI_share	scdi_pib	scdi_extdebt
Min.	NA	0.004906	NA
1st Qu.	NA	0.007890	NA
Median	NA	0.009484	NA
Mean	:NaN	0.008600	NaN
3rd Qu	NA	0.010194	NA
Max.	NA	0.010524	NA
NA's	31	27	31

Table 12: Summary Statistics on the variable of interest

	Min	1st Qu.	Median	Mean	3rd Qu.	Max.
GDP %	-22.9000	0.2715	3.1713	2.4499	6.0907	15.3292
GFCF %	-50.260	-2.611	3.623	3.256	10.726	40.389
Gov expenditure	0.9112	10.9830	15.1637	14.5346	19.4114	27.7271
Pop growth	-1.1530	-0.1557	0.4445	0.7035	1.3580	2.7641
Export	41.83	99.97	207.05	231.71	326.28	766.36
Gov fiscal balance	-12.880	-6.296	-3.218	-3.820	-2.018	8.759
Interest rate (%)	-91.721	1.188	4.335	4.599	7.756	93.915
Lending interest rate (%)	1.471	9.672	14.750	22.943	20.290	250.283
ST debt	0.000	4.263	16.575	13.906	20.680	38.528
LT_debt	5.000e+08	1.943e+10	3.144e+10	1.582e+11	6.035e+10	9.036e+11
SCDI_share	0.00003	0.00007	0.02610	0.06185	0.10185	0.33946

8.3 Table

Table 13: First stage Instrumental variable

	Dependent variable:
	SCDI_share
Government structural balance	-0.054^{***}
	(0.015)
Observations	38
R^2	0.408
F Statistic	12.391^{***} (df = 1; 18)

*p<0.1; **p<0.05; ***p<0.01

Notes: SCDI share is a share on external debt stocks. Government structural balance is the difference between revenues and expenditures of the general government adjusted to the economic cycle, in percentage of GDP. An increase of 1% of the structural balance decreases the SCDI share by 0.054%.

Table 14: Effect of SCDI take-up degree

	Dependent variable:	
	GDP annual growth rate	GFCF annual growth rate
SCDI_size	0.185	0.286
	(1.899)	(3.729)
'Short-term debt	−0.045	0.187*
	(0.048)	(0.096)
Population growth	2.038	−18.062***
	(2.162)	(4.356)
Government net lending borrowing	0.367**	0.171
	(0.146)	(0.298)
Export value index	0.004	−0.019*
	(0.004)	(0.010)
'Lending interest rate (%)'	−0.097***	−0.093*
	(0.026)	(0.052)
GFCF %	0.076**	
	(0.029)	
Government expenditure		0.908***
		(0.212)
Observations	93	93
R^2	0.494	0.632
F Statistic (df = 7; 53)	7.387***	13.024***

Note: *p<0.1; **p<0.05; ***p<0.01

GDP annual growth rate is the annual growth rate of GDP, in percentage at market prices in domestic currency. GFCF is the annual growth rate, in US dollars of gross capital formation. SCDI size is a dummy variable. Short-term debt is a share of external debt stocks. Population growth is the rate, in exponential, of growth of midyear population from one year to another, in percentage. Government net lending/borrowing is in the percentage of GDP and represents the difference between the revenues and the expenditure of the general government, including the interest rate. The export value index is the current value of exports in US dollars adjusted with 2000 as the base year. The lending interest rate is the bank rate banks set to meet short- and medium-term financial needs. Government expenditure is the total of general government expenses in the percentage of GDP. An increase of 1% of the export index increases the GDP annual growth rate by 0.004%.

Table 15: Robustness Test

	Dependent variable:	
	GDP growth annual	
	(OLS 1)	(OLS 2)
SCDI_dummy	3.990	
	(2.855)	
SCDI_DS		2.705
		(1.689)
Short-term debt	-0.198^{**}	
	(0.078)	
Population growth	-0.580	2.061
	(2.906)	(3.926)
Developement assistance	-1.113^{*}	
	(0.583)	
Export value index	0.009	0.019^{**}
	(0.006)	(0.007)
'Lending interest rate (%)'	-0.092^{***}	
	(0.027)	
GFCF %	0.076^{**}	
	(0.036)	
'Real interest rate (%)'		
'Rule of Law: Estimate'	4.459	11.526^{**}
	(3.608)	(5.096)
Government expenditure		
		(0.466)
Observations	72	46
R^2	0.491	0.652
F Statistic	4.699^{***} (df = 8; 39)	3.747^{**} (df = 7; 14)

*p<0.1; **p<0.05; ***p<0.01

GDP annual growth rate is the annual growth rate of GDP, in percentage at market prices in domestic currency. The SCDI dummy is a dummy variable that is 1 in years when SCDI was issued and 0 if otherwise. SCDI_DS is the payments of SCDI, including principal and coupon. Short-term debt is a share of external debt stocks. Population growth is the rate, in exponential, of growth of midyear population from one year to another, in percentage. Development assistance is the total of aid flows that countries receive from officials. The export value index is the current value of exports in US dollars adjusted with 2000 as the base year. The lending interest rate is the bank rate banks set to meet short- and medium-term financial needs. GFCF is the annual growth rate, in US dollars of gross capital formation. The real interest rate is the adjusted nominal rate by inflation. Rule of law captures the confidence degree of individuals towards the rule of society, contract quality, property rights, and institutional power. Government expenditure is the total of general government expenses in the percentage of GDP. An increase of 1% of the export index increases the GDP annual growth rate by 0.009%.

Data sources

Table 16: Data sources

Variable	Series	Sources
GDP %	NY.GDP.MKTP.KD.ZG	World Bank (2023)
GFCF %	NE.GDI.TOTL.KD.ZG	World Bank (2023)
Gov expenditure		International Monetary Fund (2023)
Pop growth	SP.POP.GROW	World Bank (2023)
Export	TX.VAL.MRCH.XD.WD	International Monetary Fund (2023)
Gov fiscal balance		International Monetary Fund (2023)
Interest rate (%)	FR.INR.RINR	International Monetary Fund (2023)
Lending interest rate	FR.INR.LEND	International Monetary Fund (2023)
ST debt	DT.DOD.DSTM.CD.GG.AR.US	World Bank (2023)
LT_debt	DT.DOD.DLXF.CD.GG.AR.EA.US	World Bank (2023)
Net official aid	DT.ODA.OATL.CD	World Bank (2023)
Rule of law	RL.EST	World Bank (2023)