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IMF programs and borrowing costs does size matter?

Salim Chahine [a], Ugo Panizza [b,*], Guilherme Suedekum [c]

[a] Central Bank of Lebanon & ECGI, Lebanon
[b] Geneva Graduate Institute & CEPR, Switzerland
[c] Geneva Graduate Institute, Switzerland

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ABSTRACT

This paper studies whether IMF programs and their size affect borrowing costs by comparing bonds issued immediately before the onset of the program with bonds issued immediately after the program. We show that, on average, the approval of the program leads to a 72-basis points reduction in borrowing costs and that program size matters. Our point estimates indicate that when program size increases by one percent of GDP, borrowing costs decrease by 23 basis points. We also show that program size mostly matters for ex-post programs (i.e., those implemented during crises). For precautionary ex-ante programs, there is some evidence that program size attenuates the reduction in borrowing costs. However, this effect is small and in most cases IMF programs still lead to a statistically significant reduction in borrowing costs

1. Introduction

The typical IMF program has two main objectives. The first is to provide interim financing to countries facing a crisis, allowing them to adjust their policies or respond to a major exogenous shock. The second is to catalyze private-sector financing and support countries in regaining market access. In this paper, we focus on the second objective and examine whether IMF agreements—along with the extent of their conditionality and financing levels—facilitate market access by reducing borrowing costs in the primary sovereign bond market.

We find that the presence of an IMF program is associated with a statistically significant reduction in borrowing costs. The effect is also economically significant: our baseline estimates indicate that the average coupon of bonds issued six months after the onset of a program is 70 basis points lower than the coupon of bonds issued six months before the beginning of the program. This difference corresponds to approximately 15 percent of the average coupon in our sample. We also find that, on average, borrowing costs decrease with program size: when the size of the program increases by one percent of GDP, borrowing costs decrease by 23 basis points.

Our results are important in light of the ongoing debate over the effectiveness of IMF programs in restoring confidence in capital markets. Requesting IMF support often signals that a country is experiencing severe economic and financial distress (Bas and Stone, 2014), which may lead investors to perceive the program as a negative signal or "stigma" (Essers and Ide, 2019). However, evidence of such a stigma effect may be driven by endogeneity (Gehring and Lang, 2020), and there are several reasons why IMF programs can instead catalyze private-sector financing. First, the IMF can play a role similar to that of a lender of last resort. By providing liquidity during crises, the Fund can help prevent self-fulfilling runs and restore stability (Corsetti et al., 2006; Morris and Shin, 2006). Second,

* Corresponding author.
E-mail addresses: ugo.panizza@graduateinstitute.ch (U. Panizza), Guilherme.Suedekum@graduateinstitute.ch (G. Suedekum).

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IMF programs serve a signaling function. An IMF arrangement can act as a "seal of approval" (Polak, 1991), providing reassurance that supports and clarifies needed reforms. Such programs may shape investor expectations positively by signaling that a country's policies are sustainable with a high probability of success and that the authorities are committed to implementing the agreed reforms (Marchesi and Thomas, 1999; Stone, 2002; Tirole, 2002; Edwards, 2006; Mody and Saravia, 2006). Large-scale programs, in particular, can send a strong signal that the country's debt is likely to remain sustainable and that the policy program has a high chance of success (IMF, 2023a, b).[1]

Since its creation, the IMF has continually debated how to enhance the commitment and compliance of borrower countries, resulting in lending conditions that span from broad policy targets to specific policy instruments (Gould 2001, 2003; Dreher and Vaubel, 2004a; Dreher, 2006; Kentikelenis et al., 2016; Reinsberg et al. 2022a, 2022b; Rickard and Caraway, 2014; Dell, 2019). Given the critical role of conditionality in IMF lending, we distinguish between ex-ante conditionality and ex-post conditionality. The former—a pre-qualification criteria—allows member states to benefit from financial support without any policy adjustments. The latter requires countries to implement policy adjustments to receive IMF support (Babb and Carruthers, 2008). The two key ex-ante programs are the Flexible Credit Line (FCL) and the Precautionary and Liquidity Line (PLL). We define as ex-post, programs that are negotiated when the country is already in a crisis or is at risk of entering a crisis in the near future. The main ex-post programs are Stand-by Arrangements (SBA) and Extended Fund Facilities (EFF).[2]

When we focus on ex-post programs, we find that when program size increases by one percent of GDP, borrowing costs decrease by 100 basis points. We find the opposite result for ex-ante programs. Specifically, while precautionary programs reduce borrowing costs on average, this effect diminishes as program size increases. However, the reduction in effectiveness is relatively small. Importantly, we never find that ex-ante programs lead to significantly higher borrowing costs. Rather, we find that the reduction in borrowing costs is statistically significant for smaller-scale programs and not statistically significant for larger programs.

One key contribution of our paper is methodological. Specifically, we use only bonds issued by countries under an IMF program in a relatively narrow window around the program's approval and compare the coupons of bonds issued before the onset of the program with those issued after. Our identification strategy is thus akin to a difference-in-differences approach, and our focus on a narrow window around the program's onset helps mitigate concerns related to selection into the program, as the exact timing of program approval is dictated by IMF procedures and is likely to be exogenous to country-specific circumstances. We are aware that there are trade-offs associated with our methodological approach. First, by excluding countries with no bond issuance around the onset of the program, we cannot say anything about IMF programs in countries that have lost access to the international capital market. Our results should therefore be interpreted as an assessment of IMF programs' effects on borrowing costs for countries with continuous market access. Focusing on countries that maintained market access around the onset of an IMF program allows for an apples-to-apples comparison, enabling a more precise estimate of the program's impact on borrowing costs and allowing us to further examine the catalytic role of IMF lending. Second, our approach does not allow us to assess developments beyond the study window, and we therefore cannot make claims about whether IMF programs lead to persistently lower borrowing costs.

Our work contributes to several strands of the literature on the effects of IMF arrangements. The first strand focuses on the catalytic effects of IMF programs and the role of program size, weighing the potential stigma they carry against their positive signaling role. Our finding that IMF programs reduce borrowing costs is in line with the results of Gehring and Lang (2020), who use credit ratings to show that the often-mentioned stigma effect of IMF programs is largely driven by endogenous selection. Drawing on data for over 100 countries from 1987 to 2013 and employing three alternative identification strategies, they find that although IMF programs are often associated with short-term economic contractions, they are nonetheless interpreted by financial markets as a positive signal, helping countries to restore creditworthiness. The two key differences between our work and that of Gehring and Lang (2020) are the identification strategy and our focus on bond coupons rather than credit ratings. Our results are also in line with Tartari and Tola (2019) who show that increased IMF financial assistance lowers sovereign bond spreads and Mody and Saravia (2006) who find that larger IMF programs increase the probability of bond issuance and reduce the spread of bonds issued by countries that are not too close to default (however, unlike ours, their coefficients are not always statistically significant). Eichengreen et al. (2006), by contrast, show that the opposite holds for bank loans. Chapman et al. (2017) examine IMF crisis lending between 1992 and 2002 and find that the impact of IMF programs on borrowing costs depends on political considerations. Specifically, they show that sovereign bond yields tend to decrease with larger IMF loan sizes and a greater number of program conditions, but that this effect reverses for countries deemed important to U.S. foreign policy. They interpret this finding as evidence that financial markets perceive conditionality to be less strictly enforced for politically influential countries. Our result that IMF programs are associated with lower borrowing costs are also consistent with a body of literature showing that IMF programs are positively associated with gross capital inflows. However, this

[1] Zwart (2007) describes an environment in which there is both a liquidity effect and a signalling effect. However, in his model, the signalling effect is negative (the presence of an IMF country indicates that the country is in trouble), and this negative signal can only be compensated by the positive liquidity effect of a large program. Barro (1998) also suggests that the potential presence of IMF bailouts might lead creditors to lend "at interest rates that do not reflect fundamental risk." However, large IMF programs may push private investors out because the Fund's de facto preferred creditor's status can increase private creditors' losses in case of default (for a discussion of the optimality of the Fund's preferred creditor status see Cordella and Powell, 2021).

[2] Ex-post conditionality covers macroeconomic choices related to budget deficit, interest rates or money supply. It extends to the adoption of certain economic policies or the implementation of fundamental changes such as privatization and trade liberalization. We do not consider programs, such as the Poverty Reduction and Growth Facility (PGRF), which target to low-income countries and that, rather than focusing on crisis resolution and prevention, have long-term objectives that focus on growth and poverty reduction.

literature presents mixed findings regarding program size: Van der Veer and de Jong (2010) find no significant effect, while Krahnke (2023) reports a negative relationship between program size and gross inflows. In contrast, our findings diverge from studies focusing on net inflows, which generally find no catalytic effect (Bird and Rowlands, 2002, 2008; Bauer et al., 2012) or even suggest that IMF programs reduce net inflows (Jensen, 2004; Edwards, 2006).

A second strand of literature to which we contribute consists of studies that seek to address the endogeneity of IMF program participation. As noted, we identify the effect of IMF arrangements using an estimation strategy akin to a difference-in-differences approach, which exploits the exogeneity of the precise timing of IMF program approval. Gehring and Lang (2020), by contrast, employ an instrumental variable approach based on the differential impact of changes in IMF liquidity on loan allocation. They complement this with text-based evidence from rating agency statements and the timing of IMF agreements. Mody and Saravia (2006) focus on the endogeneity of bond issuance and, following Eichengreen and Mody (2001), apply Heckman's (1979) selection model without relying on external instruments. Krahnke (2023) uses annual data on gross capital inflows and, following Gehring and Lang (2020) and Lang (2021), instruments program size with the interaction between time-varying IMF liquidity and a country's time-invariant history of IMF program participation. Essers and Ide (2019) focus exclusively on precautionary ex-ante programs and identify their effects on secondary market spreads by constructing a synthetic counterfactual.

Finally, we contribute to the literature examining how the conditionality characteristics of IMF programs influence their catalytic role (e.g., Chapman et al., 2017), with a particular focus on the distinction between ex-ante and ex-post conditionality. Existing research shows that the nature of conditionality varies depending on a country's political and economic context, as well as its ties to the Fund's major shareholders (Barro and Lee, 2005; Ivanova et al., 2003; Dreher and Jensen, 2007; Stone, 2008; Steinwand and Stone, 2008; Copelovitch, 2010; Dreher et al., 2009, 2015). The enforcement of conditionality also varies due to domestic political instability, internal fragmentation, and pressure from special interest groups such as labor unions and business associations, which can delay or even derail program implementation (Ivanova et al., 2003; Biglaiser et al., 2016; Reinsberg et al., 2019, 2022a, 2022b; Rickard and Caraway, 2019; Biglaiser and McGauvran, 2022). The choice between ex-ante and ex-post conditionality can act as a commitment device (Dhonte, 1997) or a tool for persuading governments to implement the necessary reforms (Khan and Sharma, 2001). Conditionality may also serve as a signal of borrower type and the extent of asymmetric information in the selection process (Marchesi and Thomas, 1999), or as a mechanism to mitigate moral hazard (Dreher and Vaubel, 2004b). Essers and Ide (2019) find limited evidence of beneficial effects on bond spreads and gross capital inflows for countries participating in the IMF's Flexible Credit Line. In contrast, our findings offer stronger support for the catalytic benefits of precautionary ex-ante programs, showing that, on average, such programs significantly reduce borrowing costs, although this effect is moderated by program size.

The rest of the paper is organized as follows: Section 2 describes our data; Section 3 illustrates our empirical strategy with special focus on how we address endogeneity and presents our main results; Section 4 conducts a battery of robustness checks; and Section 5 concludes.

2. Data

To study the impact of IMF programs on borrowing costs, we merge macro-level information on IMF programs, country characteristics, and global financial conditions with bond-level data for all long-term sovereign bonds issued in international markets by countries undergoing an IMF program. Our focus is on countries that accessed the Fund's non-concessional credit facilities and issued long-term sovereign bonds in the international market within a twelve-month window (six months before and six months after) around the onset of the program. The programs we consider include both *ex-post* arrangements—such as the Stand-By Arrangement (SBA) and

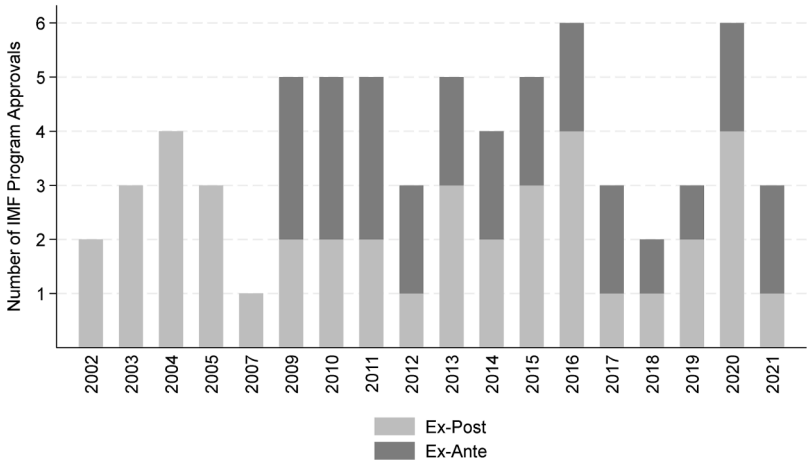

Fig. 1. Arrangements included in the sample by year and type.
The figure shows the number of arrangements included in our sample by year program type. Stand-by Arrangements (SBA) and Extended Fund Facilities (EFF) are classified as ex-post, Flexible Credit Lines (FCL) and Precautionary Liquidity Lines (PLL) are classified as ex-ante.

Table 1
Bond Characteristics around IMF Program Agreements. This table reports summary statistics for the coupons (top panel) and maturity (bottom panel) of all the bonds included in our sample. Each panel shows summary statistics for all bonds and then splits them for bonds issued within 180 days before and 180 days after the beginning of the program. Each panel also shows separate summary statistics for ex-ante and ex-post programs.

	Mean	Median	Std. Dev.	Obs.	Countries
			Coupon (%)		
All Bonds issued around IMF programs	5.07	4.75	2.81	408	23
Within 180 days before the program	4.92	4.62	2.99	179	23
Within 180 days after the program	5.18	4.88	2.67	229	23
Ex-Post Programs	6.64	6.88	2.73	216	19
Within 180 days before the program	6.60	6.88	2.97	93	19
Within 180 days after the program	6.67	6.88	2.55	123	19
Ex-Ante Programs	3.29	3.38	1.58	192	6
Within 180 days before the program	3.11	3.00	1.65	86	6
Within 180 days after the program	3.45	3.55	1.51	106	6
			Maturity (years)		
All Bonds issued around IMF programs	12.09	10.01	11.90	408	23
Within 180 days before the program	11.01	10.01	10.04	179	23
Within 180 days after the program	12.93	10.02	13.14	229	23
Ex-Post Programs	9.41	9.27	7.15	216	19
Within 180 days before the program	9.35	9.68	7.25	93	19
Within 180 days after the program	9.46	9.01	7.10	123	19
Ex-Ante Programs	15.10	10.04	15.08	192	6
Within 180 days before the program	12.79	10.03	12.17	86	6
Within 180 days after the program	16.96	10.40	16.90	106	6

the Extended Fund Facility (EFF)— and *ex-ante* arrangements, such as the Flexible Credit Line (FCL) and the Precautionary and Liquidity Line (PLL).[3] Our baseline dataset includes 408 bond issuances spanning 68 IMF programs in 23 countries from November 2001 to February 2022. Bond-level data are sourced from Dealogic and S&P Capital IQ, data from IMF programs are from the IMF MONA database, and macro-level data are from the World Bank Open Data and Datastream. Our sample includes almost all FCL and PLL arrangements approved between 2002 and February 2022 (24 out of 25 and 3 out of 5, respectively) and nearly 40% of EFF and SBA agreements (12 out of 31 and 29 out of 78, respectively) approved over the same period.[4] Fig. 1 shows the number of arrangements by arrangement type and year and Appendix Table A1 provides a list of all the arrangements included in our sample.

Since we lack data on the yield to maturity at issuance for some bonds, our analysis focuses on the bond coupon instead. This should not be an issue because, in our sample, the coupon closely tracks the yield to maturity at issuance. Specifically, we have information on both coupons and yield to maturity for 70 percent of the bonds included in our baseline sample (287 out of 408). For this subsample of bonds, the average coupon is 5.39 (with a standard deviation of 2.47), and the average yield to maturity at issuance is 5.35 (with a standard deviation of 2.46). The correlation between the coupon and the yield to maturity is 0.99 and is statistically significant at the 1 percent confidence level for the full sample and when we split the sample between bonds issued before and after the onset of the program.

In the full sample, the average coupon is 5.07 percent with a standard deviation of 2.8 (top panel of Table 1).[5] When we split the sample between bonds issued before and after the onset of the program, we find that bonds issued after the program have a slightly higher coupon (5.18 percent versus 4.92 percent). However, the difference between the two groups is not statistically significant. The average bond maturity in the full sample is 12.1 years, and bonds issued after the onset of the program have an average maturity that is nearly two years longer than the average maturity of bonds issued before the onset of the program (12.9 years versus 11.01 years,

[3] The PLL was designed to prevent crises stemming from liquidity needs of countries with strong fundamentals but with some remaining vulnerabilities that prevent them from accessing the FCL. To be eligible for a PLL program, countries need to have a strong performance in three out of the five following qualification areas: (i) external position and market access, (ii) fiscal policy, (iii) monetary policy, (iv) financial sector soundness and supervision, and (v) data adequacy. However, substantial underperformance in any of these areas would make the country not eligible. Therefore, given the overall positive macroeconomic policy framework that this facility requires, we classify its arrangements as ex-ante.

[4] Over the 20-year period that we consider, 65 countries borrowed from the Fund on non-concessional terms through 163 programs, we obtain our baseline sample of 68 programs in 23 countries after excluding (1) 75 programs (in 25 countries) for which there were no international issuances in a 12-month window around the program, (2) 9 programs (in 7 countries) for which there were no international issuances in the six months before the approval of the program, (3) and 11 programs (in 10 countries) for which there were no international issuances in the six months after the approval of the program.

[5] The fact these values are close to the subsample of bonds for which we have information on yield to maturity suggests that the 278 bonds for which we have full information are representative of the full sample.

bottom panel of Table 1) We also find that average coupons for ex-post programs are significantly higher than the average coupon for ex-ante programs (6.64 percent versus 3.29 percent) and average maturity is considerably shorter (9.4 years versus 15.1 years). This is expected because ex-post programs are granted to countries facing a crisis, while ex-ante programs are given to non-crisis countries with strong fundamentals and good policies and institutions. Within the groups of ex-ante and ex-post programs, there is virtually no difference in average coupons of bonds issued before and after the onset of the program. The next section will show that things change dramatically using regression analysis and moving beyond simple univariate comparisons. Focusing on maturity, we find no difference between bonds issued before and after the onset of the program for ex-post programs but a much longer maturity for bonds issued after ex-ante programs (nearly 17 years versus 12.8 years, on average).

Our key explanatory variables are a dummy that takes value one after the onset of the program, a continuous measure of program size, and the interaction between these two variables. To measure program size, we follow Krahnke (2023) and use GDP to scale the Fund's financial assistance to a given country. Specifically, we take the total access granted in SDRs to a country under the program, adjust it for the exchange rate on the day of the program approval (sourced from Datastream), and normalize it by the country's GDP in the previous year. Our controls include bond maturity (sourced from Dealogic and S&P Capital IQ), GDP per capita, the number of past IMF programs, and global financial conditions.

3. Empirical strategy and baseline results

To assess the role of IMF programs on borrowing costs, we start by estimating a model in which we regress the bond's coupon at issuance over an IMF program dummy, bond characteristics, country-time varying characteristics, global financial conditions, and a set of fixed effects that control for global shocks in the month of issuance, country-program type time-invariant characteristics, and currency of issuance. Formally, we estimate:

$$C_{b(i,p,\ x),t(y)} = \alpha IMF_{i(p),t(y)} + \beta \ln\left(MAT_{b(i,p,x),t}\right) + \gamma GDP\ PC_{i,y-1} + \delta NP_{i,t(y)} + \\ + \theta \ln\ \left(VIX_{t(y)}\right) + \omega BB_{b(i,x),t} + \mu_{i,a} + \xi_x + \tau_{m(y)} + \varepsilon_{b(i,p,\ x),t(y)} \tag{1}$$

Where $C_{b(i,\ p,\ x),t(y)}$ is the coupon of bond b, issued by country i around a program p on day $t(y)$ and denominated in currency x; $IMF_{i(p),t(y)}$ is a dummy variable that takes value one if on day $t(y)$ country i had an IMF program of type p; $MAT_{b(i,p,x),t}$ is the maturity (in year) of the bond; $GDP\ PC_{i,y-1}$ is the GDP per capita of country i in year $y-1$; $NP_{i,t(y)}$ is the total number of IMF programs that country i had up to time $t(y)$, $VIX_{t(y)}$ is the VIX index on day $t(y)$, $BB_{b(i,x),t}$ is dummy variable that takes value one for an Ecuadorian bond issued in 2019 to conduct a liability management operation which resulted in a buy-back operation of a high-interest rate bond issued in 2015 and maturing in 2020 (more on this below); $\mu_{i,a}$ are country-program type fixed effects (where program type is either ex-ante or ex-post), ξ_x are currency fixed effects, and $\tau_{m(y)}$ are month fixed effects.[6]

Our first key parameter of interest is α. Given that we only include bonds issued within a six-month window around an IMF program and we control for global shocks (both through the VIX and the month fixed effects) and for country and bond characteristics, α measures whether bonds issued in the aftermath of an IMF program have coupons which are significantly different from similar bonds issued before the program.

While we are confident that we can attach a causal interpretation to α *within our sample*, we are aware that our specification might suffer from selection bias because our sample only includes countries that issued bonds around an IMF program. Our results should thus be interpreted as an estimation of the impact of an IMF program on borrowing costs for countries that do have a program and issue bonds. We cannot say anything about countries that would like to have a program but are unable to meet the preconditions of an initial staff-level agreement or about the long period that might precede the beginning of the program.

As mentioned, $BB_{b(i,x),t}$ is a dummy variable that takes value one for a $1.125 billion 10-year bond issued by Ecuador in 2019 to raise the funds necessary to buy back a 5-year bond issued in May 2015. We use a dummy for this bond because its issuance was linked to an atypical liability management operation, allowing Ecuador to extend its external debt's average maturity and reduce its total interest costs.[7] The results are identical if we drop the bond from the sample.

We find that α is negative and statistically significant (column 1, Table 2). The point estimate implies that the onset of an IMF program is associated with a reduction in borrowing costs of 72 basis points. This is exactly the opposite of what we found in the simple mean comparison (which does not control for bond and country characteristics and global conditions) of Table 1. Note that the point estimate is also economically significant, indicating that an IMF program reduces borrowing costs by nearly 15 percent.

All other coefficients are as expected. GDP per capita is negatively associated with borrowing costs, and long-term bonds have higher coupons. The point estimate implies that a one-year increase in maturity is associated with a one percent (or 5 basis points)

[6] The country program-type fixed effects vary across country and program type. For instance, the Colombian ex-post program of 15 January 2003 and the Colombian ex-ante program of 11 May 2009 are assigned separate fixed effects, while the Colombian ex-ante programs of 11 May 2009 and 7 May 2010 are assigned the same fixed effect. We will also report results that use country-program fixed effects and thus have separate fixed effects for each country and program.

[7] The bonds issued in 2015 carried a very high coupon because of the low price of oil (Ecuador's main export) and because they were among the first international issuances after President Correa's strategic default and secret bond buybacks that took place in the last quarter of 2008. IMF (2015) documents that the 2020 bond issued in 2015 had a spread which was about 200 basis points higher than that of a set of comparator countries. Feibelman (2017) and Porzekanski (2010) provide details (with very different perspectives) on the Ecuadorian default and successive buyback.

Table 2
IMF Programs and Borrowing Costs. This table reports a set of regressions where the dependent variable is the bonds' coupon, and the explanatory variables are a dummy that takes value one after the onset of the program (*IMF*), two dummies that separate ex-ante and ex post programs (IMF Ex post and IMF Ex ante), log bond maturity (ln(*MAT*)), GDP per capita (*GDP PC*), total number of IMF programs in a given country (*NP*), the log of the VIX index (ln(*VIX*)), and a dummy that takes value one for the Ecuador buy-back bond (*BB*). All regressions include country-program type, currency of issuance, and month-year fixed effects. Columns 1 and 3 include all bonds, column 2 excludes the Ecuador buy-back bond, column 4 only includes bonds issued around ex-post programs, and column 5 only includes bonds issued around ex-ante programs, and column 6 uses the bonds' yield to maturity at issuance as dependent variable instead of coupon.

	(1)	(2)	(3)	(4)	(5)	(6)
IMF	-0.723**	-0.723**		-1.839	-0.557	-0.878***
	(0.318)	(0.317)		(1.612)	(0.335)	(0.257)
IMF Ex post			-1.043*			
			(0.543)			
IMF Ex ante			-0.507*			
			(0.265)			
ln(*MAT*)	1.029***	1.029***	1.018***	1.309***	0.985***	0.989***
	(0.101)	(0.101)	(0.104)	(0.138)	(0.081)	(0.146)
NP	0.265	0.265	0.244	-1.773*	-0.00254	0.532*
	(0.228)	(0.228)	(0.214)	(1.003)	(0.107)	(0.281)
GDP PC	-0.090***	-0.090***	-0.078**	-0.142	-0.103**	-0.041
	(0.0242)	(0.024)	(0.030)	(0.419)	(0.029)	(0.053)
ln(*VIX*)	0.539	0.539	0.610	1.499***	-0.144	0.579
	(0.439)	(0.439)	(0.464)	(0.468)	(0.215)	(1.109)
BB	10.450***		10.730***	11.080***		-1.176
	(0.330)		(0.552)	(0.871)		(1.775)
Observations	408	407	408	216	192	287
Countries	23	23	23	19	6	23
Type of IMF Program	All	Excl. BB	All	Ex-Post	Ex-Ante	All
Country-Program Type FE	✓	✓	✓	✓	✓	✓
Currency-Issuance FE	✓	✓	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.842	0.835	0.842	0.892	0.938	0.872

Robust standard errors clustered at the country-program type-level are reported in parentheses.
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

increase in the coupon. We also find that bonds issued during periods of high-risk aversion (as measured by the VIX index) and by countries that already had many IMF programs tend to have higher coupons. However, the coefficients are not statistically significant, probably because of the presence of country-program type and month fixed effects, which amplify the noise-to-signal ratio of variables with limited within-country and within-month variation (Barro, 2015). As mentioned, the results are identical if we drop the Ecuador buy-back bond (Column 2).

As a next step, we separate IMF programs with ex-post conditionality from those with ex-ante conditionality (see above for a definition and description of the two types of programs). We find that the program's effect remains significant and negative for both types of programs (column 3 of Table 2) but the point estimate is twice as large for ex-ante programs (100 versus 50 basis points). As the average coupon in the sample of bonds issued around ex-post programs is about twice that of bonds issued around ex-ante programs, the percentage reduction in borrowing costs brought about by the two types of programs is basically identical. We also estimate separate regressions for ex-ante and ex-post programs (columns 4 and 5) and find results quantitatively similar to those of column 3. In this case, however, the coefficient attached to the IMF program dummy is no longer statistically significant. This result is partly due to the small number of countries with ex-ante programs but, as shown below, also related to the fact that the relationship between borrowing costs and program size goes in opposite directions for ex-ante and ex-post programs.

As mentioned in Section 2, we focus on coupons due to data limitations on yields to maturity. This should not pose an issue since, as shown earlier, the two variables are highly correlated. To probe further, we re-estimate our baseline model by substituting the coupon with the yield to maturity (see Column 6 of Table 2). Despite the smaller sample size, the results are qualitatively similar to those obtained using the coupon. In fact, when we use the yield to maturity, we find an even stronger (88 versus 72 basis points) and more precisely estimated reduction in borrowing costs associated with the onset of an IMF program. Given that the results are similar, and we have a larger sample size when focusing on coupons, the remaining empirical investigations use coupon as a dependent variable.

Having established that, on average, IMF programs are associated with a reduction in borrowing costs, we now study whether the size of the program matters by estimating the following model:

$$C_{b(i,p,\ x),t(y)} = \alpha IMF_{i(p),t(y)} + \phi\widetilde{SDR}_{i(p),t(y)} + \psi\left(IMF_{i(p),t(y)} \times \widetilde{SDR}_{i(p),t(y)}\right) + \tag{2}$$

$$\beta\ln\left(MAT_{b(i,p,x),t}\right) + \gamma\ln\left(GDP\ PC_{i,y-1}\right) + \delta NP_{i,t(y)} + +\theta\ln\left(VIX_{t(y)}\right) + \omega BB_{b(i,x),t} + \mu_{i,a} + \xi_x + \tau_{m(y)} + \varepsilon_{b(i,p,\ x),t(y)}$$

In Eq. (2), $\widetilde{SDR}_{i(p),t(y)} = SDR_{i(p),t(y)} - \overline{SDR}$, where $SDR_{i(P),t(y)}$ is country i, program p SDR access over GDP at time $t(y)$ and $\overline{SDR}$ is the average value of $SDR_{i(p),t(y)}$. Thus, α measures how an IMF program with average SDR access affects borrowing costs and ψ, our second key parameter of interest, measures how the relationship between borrowing costs and the presence of an IMF program varies with the size of the program. Formally:

$$\frac{\partial C_{b(i,p,\ x),t(y)}}{\partial IMF_{i(p),t(y)}} = \alpha + \psi\widetilde{SDR}_{i(p),t(y)}$$

All other variables of Eq. (2) are as in Eq. (1).

As discussed above, focusing on a narrow window around a program allays concerns about causality in the estimation of α. However, the endogeneity related to program size might affect our other key parameter of interest ψ. To show that our estimate of ψ is consistent, we start by recognizing that SDR access is determined by both exogenous and endogenous (with respect to the crisis to which the program is responding to) criteria. The size of programs with normal access are mostly exogenous because they are based on a country's IMF quota, which is a slowly changing variable and predetermined with respect to the onset of the crisis.[8] Programs with a size that goes beyond normal access need to conform to the Exceptional Access Policy, which requires that: (i) the country is experiencing exceptional balance of payment pressure; (ii) debt is sustainable with high probability; (iii) there are good prospects for regaining market access within the time frame of the program; and (iv) the program is likely to be successful.[9]

Before the program is approved, investors know for sure about point (i) as they observe the depth of the crisis and price it when buying government bonds issued by the crisis country. Thus, the positive correlation between the size of the possible program and the depth of the crisis leads to a positive endogeneity bias in the estimated effect of program size on borrowing costs before the program is approved (this is parameter ϕ in Eq. (2)).[10] After the IMF Board approves a large program, investors acquire new positive pieces of information: according to the IMF Board, debt is sustainable with high probability; the country is likely to regain market access, and the program will likely succeed. This is the new positive information associated with implementing a large program, and this positive information should lead to a reduction of borrowing costs with no obvious endogeneity bias.

It is possible to show that $\widehat{\psi}$ is consistent even if $\widehat{\phi}$ is biased. Specifically, Nizalova and Murtashazvili (2016) derive the conditions under which the estimated coefficient on an interaction of an exogenous and an endogenous regressor can be interpreted causally. We derive the exact conditions for Eq. (2) in the online appendix. Note that the derivation in the online appendix assumes that the exact timing of the program is exogenous. Above we justified this assumption using institutional features related to the schedule of IMF board meetings which is, at least in part, exogenous to country specific circumstances. It is, however, possible that the exact meeting time is endogenous for countries that are facing a deep crisis. This is not the case for our sample of ex-ante arrangements and it is also unlikely to be the case for our sample of ex-post arrangements given that we focus on countries that preserve market access. However, for this latter group of countries endogeneity cannot be fully ruled out and thus our results should be interpreted with some caution. While recognizing that identification is rarely fully airtight, the derivations provided demonstrate that, at a minimum, our empirical methodology helps to mitigate most potential endogeneity concerns.

We find that, for country-years with average program size, post-program borrowing costs decrease by 71 basis points (column 1 of Table 3; this is virtually the same as what we found in Table 2) and that, before the onset of the program, countries with high-SDR access had higher borrowing costs. The point estimate implies that a one percent of GDP increase in program size is associated with a 30 basis points increase in pre-program borrowing costs (remember that this estimate is likely to suffer from an upward bias). More interestingly, we find that the interactive coefficient is negative and statistically significant. It indicates that each percent of GDP in program size decreases post-program borrowing costs by 23 basis points.

Fig. 2 plots the marginal effect of program size (the horizontal axis of the figure uses *SDR* instead of its demeaned value $\widetilde{SDR}$). Post-program borrowing costs are higher (but the difference with respect to pre-program borrowing costs is not statistically significant) for small programs (when SDR access is less than 2.5 percent of GDP). However, they become significantly lower than pre-program borrowing costs when SDR access reaches 5 percent of GDP. The results are identical when we drop the Ecuador buy-back bond

[8] Between 2016 and March 2023 normal access limits were 145 percent of quota in a given year and 435 percent of quota overall. In March 2023, these limits were temporarily increased to 200 percent and 600 percent, respectively (IMF, 2023a). Prior to 2016, normal access limits were 200 percent and 600 percent of quota, respectively. The decision to reduce access quota in 2016, was linked to the doubling of members' quota under the 14th review of quotas which was initiated in 2010 and concluded in 2016. The combination of reduced access limits and higher quotas led to a 45 percent average increase of access in SDR terms (IMF 2016).

[9] Note that these criteria have evolved over time since the exceptional access policy was first established in 2002. For details see IMF (2023b).

[10] This is from the standard omitted variable bias formula. Assume that the true model is: $C = \alpha + \phi SDR + \lambda X + u$ and that X is the depth of the crisis. This latter variable is positively associated with borrowing costs ($\lambda > 0$) and positively correlated with program size. If we estimate $C = \alpha + \phi SDR + u$, we get that: $\widehat{\phi} = \phi + \lambda\frac{Cov(SDR,X)}{Var(SDR)}$. Since $Cov(SDR,X) > 0$, we have $\lambda\frac{Cov(SDR,X)}{Var(SDR)} > 0$ and $\widehat{\phi} > \phi$.

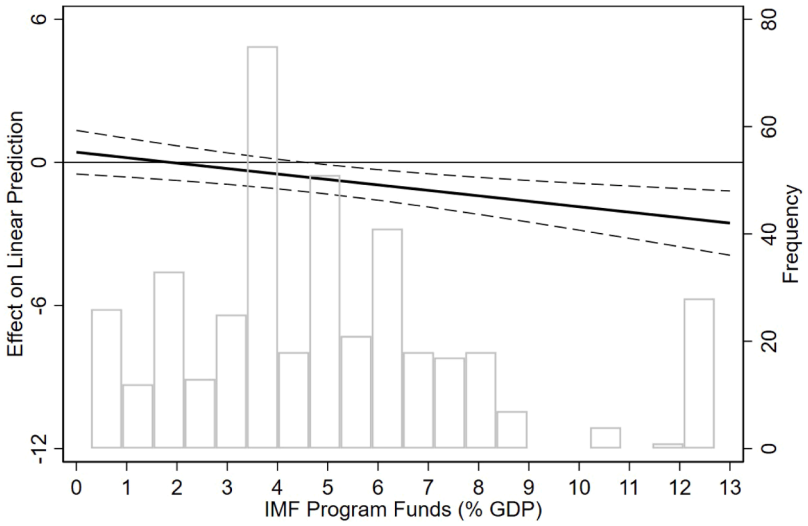

Fig. 2. Borrowing costs and program size (ex-post and ex-ante programs).
The figure is based on the estimations of column 1 of Table 3 and shows (on the left-hand side axis) the effect of an IMF program on borrowing costs for programs with different sizes. The solid back line shows the point estimates and the dashed lines show the 95 percent confidence interval. The vertical bars show the frequency of programs with different sizes.

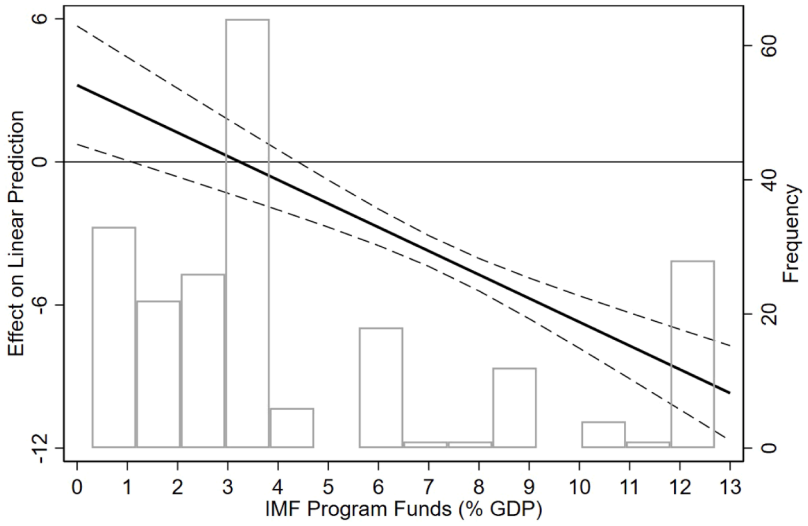

Fig. 3. Borrowing Costs and Program Size (Ex-Post Programs).
The figure is based on the estimations of column 3 of Table 3 and shows (on the left-hand side axis) the effect of an IMF program on borrowing costs for ex-post programs with different sizes. The solid back line shows the point estimates and the dashed lines show the 95 percent confidence interval. The vertical bars show the frequency of programs with different sizes.

(column 2).

Next, we run separate regressions for ex-ante and ex-post programs. We do not use triple interactions because they are difficult to interpret and do not allow for different coefficients across the full set of controls and fixed effects.

The results for ex-post programs are qualitatively like those we obtained for the full sample. However, the average reduction in borrowing costs is much larger. Post-program coupons for the country-year with the average program size are 142 basis points lower than pre-program borrowing costs (column 3). This is twice as large as our finding in column 1. The coefficient of program size is instead like the one in column 1: the point estimate implies that borrowing costs increase by 32 basis points when program size increases by one percent of GDP (again, this estimate is likely to be upward biased). The interactive term shows that post-program borrowing costs decrease by 100 basis points when program size increases by one percent of GDP (column 3, Table 3). This decrease is more than three times what we found in column 1.

Fig. 3 plots the marginal effects of an IMF program at different program sizes. Post-program borrowing costs are higher than pre-

Table 3
Size of IMF Programs and Borrowing Costs. This table reports a set of regressions where the dependent variable is the bonds' coupon, and the explanatory variables are a dummy that takes value one after the onset of the program (*IMF*), the demeaned value of program size ($\widetilde{SDR}$), the interaction between IMF and $\widetilde{SDR}$, the log bond maturity (ln(*MAT*)), GDP per capita (*GDP PC*), total number of IMF programs in a given country (*NP*), the log of the VIX index (ln(*VIX*)), and a dummy that takes value one for the Ecuador buy-back bond (*BB*) and a dummy that takes value one for large programs (*LP*). All regressions include country-program type, currency of issuance, and month-year fixed effects. Columns 1 and 5 include all bonds, column 2 excludes the Ecuador buy-back bond, column 3 only includes bonds issued around ex-post programs, and column 4 only includes bonds issued around ex-ante programs.

	(1)	(2)	(3)	(4)	(5)	(6)
IMF	-0.709**	-0.709**	-1.422**	-0.619*	-0.682**	-2.771***
	(0.313)	(0.312)	(0.547)	(0.268)	(0.298)	(0.193)
$\widetilde{SDR}$	0.300***	0.300***	0.315***	0.033	0.558***	1.453***
	(0.098)	(0.098)	(0.035)	(0.045)	(0.197)	(0.0621)
$IMF \times \widetilde{SDR}$	-0.229***	-0.229***	-0.993***	0.283***	-0.326**	-0.731***
	(0.074)	(0.074)	(0.168)	(0.040)	(0.123)	(0.0555)
ln(*MAT*)	1.051***	1.051***	1.314***	0.979***	1.140***	1.309***
	(0.099)	(0.099)	(0.141)	(0.085)	(0.104)	(0.144)
NP	0.204**	0.204**	-6.783***	0.261	0.500***	1.015**
	(0.0983)	(0.0982)	(0.631)	(0.173)	(0.179)	(0.439)
GDP PC	-0.070***	-0.070***	-0.315	-0.069*	-0.031	0.262***
	(0.023)	(0.023)	(0.188)	(0.032)	(0.035)	(0.085)
ln(*VIX*)	0.824*	0.824*	1.054***	-0.0950	0.478	1.218***
	(0.478)	(0.478)	(0.364)	(0.281)	(0.404)	(0.387)
BB	10.720***		10.890***		10.910***	13.380***
	(0.248)		(0.326)		(0.273)	(0.163)
LP					-3.784**	-12.050***
					(1.168)	(0.538)
Observations	408	407	216	192	408	216
Countries	23	23	19	6	23	19
IMF Program Type	All	Excl. BB	Ex-Post	Ex-Ante	All	Ex-Post
Country-Program Type FE	✓	✓	✓	✓	✓	✓
Currency-Issuance FE	✓	✓	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.855	0.849	0.902	0.939	0.878	0.905

Robust standard errors clustered at the country-program type-level are reported in parentheses.
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

program borrowing costs when the program is less than 3 percent of GDP (marginally significant for very small programs of less than 1 percent of GDP). However, they decrease rapidly and become significantly smaller than pre-program borrowing costs when the programs exceed 4 percent of GDP.

When we focus on ex-ante programs, we find that the main effect of the program dummy remains negative and statistically significant, but it is less than half that of the sample of ex-post programs (0.6 versus 1.4; compare columns 3 and 4 of Table 3). The coefficient of program size is positive, but close to zero and far from being statistically significant. There are two possible interpretations for this result. The first is what the point estimate tells us: program size matters for borrowing costs before ex-post programs, and it does not matter for ex-ante programs. The second has to do with endogeneity. Ex-post programs tend to happen during crisis periods in countries with weak policies and institutions, and program size can be a proxy for the depth of the crisis, leading to the pre-program endogeneity bias discussed above. Ex-ante programs, instead, tend to be implemented in countries that usually have strong institutions yet face some financial and economic turmoil in either tranquil periods or when there are global shocks.[11]

Focusing on our second key parameter of interest, we find that in ex-ante programs the interaction between the program dummy

[11] Examples of the first type of ex-ante programs are the Colombian, Mexican and Polish FCL agreements signed between 2009 and 2019 and the Moroccan PLL agreements of 2012 and 2014. Examples of the second type are the agreements signed in response to the Covid pandemic such as the 2020 and 2021 FCL agreements of Colombia, Mexico and Peru and the 2021 PLL agreement of Panama.

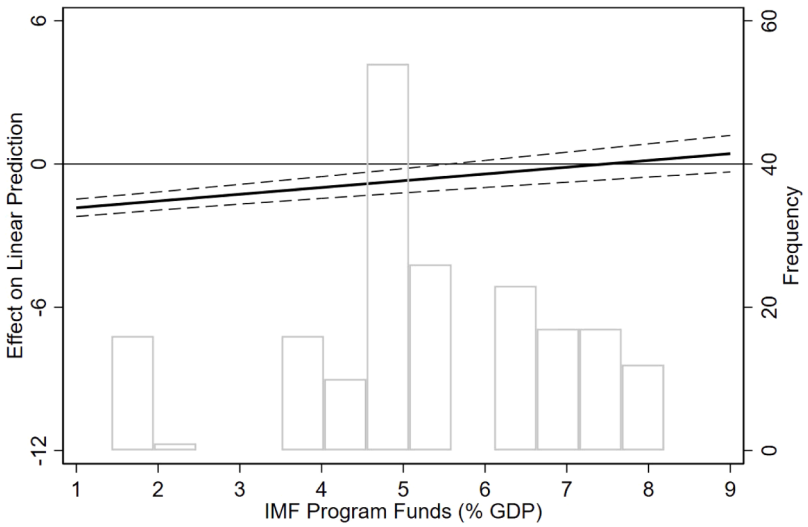

Fig. 4. Borrowing costs and program size (ex-ante programs).
The figure is based on the estimations of column 4 of Table 3 and shows (on the left-hand side axis) the effect of an IMF program on borrowing costs for ex-ante programs with different sizes. The solid back line shows the point estimates and the dashed lines show the 95 percent confidence interval. The vertical bars show the frequency of programs with different sizes.

and program size is *positive* and statistically significant. This latter result is puzzling as it implies that program size attenuates the overall beneficial effect of the IMF program. Our results indicate that a country that fulfilled the ex-ante conditionality, i.e., which met the pre-qualification criteria to benefit from financial support without policy adjustments, is a relatively well-perceived country by investors. However, in the presence of asymmetric information between governments and investors (Phan, 2017; Joo, Lee, and Yoon, 2023), larger programs might increase uncertainty and borrowing costs. Having said that, Fig. 4 shows that the marginal effect is never positive and statistically significant. It is negative and statistically significant for small and medium-sized programs (up to 6 percent of GDP), and it becomes positive (but never statistically significant) only for large programs with SDR access that surpasses 8 percent of GDP. This result indicates that ex-ante programs significantly reduce borrowing costs when the program is not very large and have no significant effect on borrowing costs when they become very large.

As our sample includes a few very large programs, we check whether our results are robust to controlling for a possible differential effect of these large programs. To this end, we augment Eq. (2) with a large program dummy, which takes value one for programs with SDR access (scaled by GDP) at least two standard deviations above the average program[12]. Columns 5 and 6 of Table 3 show that our results are robust to controlling for large programs (note that there are no programs for which the dummy takes value one in the sample of ex-ante programs).

Larger programs might come with tighter conditionality, and it is possible that markets care more about conditionality than about the size of the program. To address this possible confounding factor, we use data on program goals from the IMF MONA database to measure the conditionalities associated to each program. In building this indicator, we assume that if a program has a specific goal—for instance, inflation control—the disbursement is conditional on implementing policies aimed at achieving such goal. We were able to obtain information for 54 out of the 68 arrangements included in our sample and thus lose information for 50 bond issuances.[13]Given the smaller sample, we start by estimating our baseline models of column 1 in Tables 2 and 3 on the smaller sample for which we have data on IMF conditionality and show that the results are similar to what we obtain in the full sample (see column 1 and 2 of Table 4). Next, we augment the model with the number of conditionalities (centered at zero like program size) and its interaction with the IMF arrangement dummy and find that none of these variables is significantly associated with borrowing costs (column 3 of Table 4), while the IMF dummy remains both negative and statistically significant. Finally, we run a horserace regression in which we include both the interaction between program size and the IMF arrangement dummy and the interaction between the number of conditionalities and the IMF dummy (column 4, Table 4). We find that the interaction with program size remains negative and statistically significant while the number of conditionalities remain insignificant.

As a final step, we estimate a model that controls for IMF program (rather than country-program type) fixed effects:

[12] The dummy takes value one for the following three programs: Ukraine, 2010 (SDR access was 12.5 percent of GDP); Ukraine 2015 (SDR access was 12.7 percent of GDP); and Jamaica 2016 (SDR access was 11.6 percent of GDP).

[13] We do not have information for the following arrangements: Bulgaria (August 2004) Colombia (May 2005 and January 2003); Croatia (February 2003; August 2004); Guatemala (April 2003); Peru (June 2004 and January 2007); Serbia (September 2011); Turkey (May 2005); Ukraine (March 2004); Uruguay (April 2002 and June 2005).

Table 4
Size of IMF Programs, Conditionality and Borrowing Costs. This table reports a set of regressions where the dependent variable is the bonds' coupon. Column 1 shows the same model of column 1 of Table 2 but using the sample for which we have data on conditionalities. Column 2 shows the same model of column 1 of Table 3 but using the sample for which we have data on conditionalities. Column 3 augment the model with the demeaned value of the number of conditionalities ($\widetilde{COND}$) and the interaction between IMF and $\widetilde{COND}$. Column 4 also includes the demeaned value of program size ($\widetilde{SDR}$), the interaction between IMF and $\widetilde{SDR}$. All the other variables are as in Table 2.

	(1)	(2)	(3)	(4)
IMF	-0.609*	-0.689**	-0.728*	-0.907***
	(0.291)	(0.292)	(0.348)	(0.309)
$\widetilde{SDR}$		0.279**		0.319***
		(0.0976)		(0.103)
$IMF \times \widetilde{SDR}$		-0.218***		-0.164**
		(0.0711)		(0.0743)
$\widetilde{COND}$			0.137	0.322
			(0.185)	(0.214)
$IMF \times \widetilde{COND}$			-0.104	-0.153
			(0.140)	(0.0982)
ln(*MAT*)	1.016***	1.036***	1.005***	1.015***
	(0.088)	(0.0838)	(0.0945)	(0.0927)
NP	0.275	0.219**	0.354	0.378**
	(0.234)	(0.0998)	(0.318)	(0.154)
GDP PC	-0.083***	-0.0644**	-0.0757*	-0.0489
	(0.023)	(0.0233)	(0.0362)	(0.0308)
ln(*VIX*)	0.510	0.821	0.731	1.170*
	(0.469)	(0.533)	(0.589)	(0.563)
BB	10.329***	10.57***	10.75***	11.50***
	(0.338)	(0.252)	(0.765)	(0.597)
Observations	358	358	358	358
Countries	18	18	18	18
IMF Program Type	All	All	All	All
Country-IMF Program FE	✓	✓	✓	✓
Currency-Issuance FE	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓
Adjusted R^2	0.861	0.873	0.863	0.879

Robust standard errors clustered at the country-program type-level are reported in parentheses.
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

$$C_{b(i,p,\ x),t(y)} = \alpha IMF_{i(p),t(y)} + \psi\left(IMF_{i(p),t(y)} \times \widetilde{SDR}_{i(p),t(y)}\right) + \beta \ln\left(MAT_{b(i,p,x),t}\right) + \theta \ln\left(VIX_{t(y)}\right) + \omega BB_{b(i,x),t} + \mu_{i,p} + \xi_x + \tau_{m(y)} + \varepsilon_{b(i,p,\ x),t(y)} \quad (3)$$

The key difference between Eqs. (2) and (3) is that the former includes a set of fixed effects that only vary across countries and program type ($\mu_{i,a}$), while the latter includes a full set of country-program fixed effects ($\mu_{i,p}$). Given that GDP per capita and program size do not vary within a specific program, we cannot include GDP per capita or estimate the main effect of program size when we control for country-type fix. However, we can still estimate the interaction between program size and the IMF program dummy because the latter varies within programs.

Controlling for program fixed effects confirms that the program size is associated with a reduction of borrowing costs in the full sample and the sample of ex-post programs (columns 1 and 2 of Table 5). Instead, we do not find any significant effects of ex-ante programs (column 3 of Table 5).

Summing up, we find that: (i) IMF programs lead to a reduction in borrowing costs in a 6-month window around the program; (ii) on average, the post-program reduction in borrowing costs is positively associated with program size (as measured by SDR access over GDP); and (iii) that ex-post programs drive the latter results.

Table 5
Size of IMF Programs and Borrowing Costs with Program Fixed Effects. This table reports a set of regressions where the dependent variable is the bonds' coupon, and the explanatory variables are a dummy that takes value one after the onset of the program (*IMF*), the interaction between IMF and the demeaned value of program size ($IMF \times \widetilde{SDR}$), the log bond maturity (ln(*MAT*)), GDP per capita (*GDP PC*), total number of IMF programs in a given country (*NP*), the log of the VIX index (ln(*VIX*)), and a dummy that takes value one for the Ecuador buy-back bond (*BB*). All regressions include country-program, currency of issuance, and month-year fixed effects. Column 1 includes all bonds, column 2 only includes bonds issued around ex-post programs, and column 3 only includes bonds issued around ex-ante programs.

	(1)	(2)	(3)
IMF	-1.094	-2.771***	-0.570
	(0.966)	(0.195)	(0.907)
$IMF \times \widetilde{SDR}$	-0.398***	-0.731***	0.573
	(0.147)	(0.055)	(0.769)
ln(*MAT*)	1.188***	1.309***	0.954***
	(0.112)	(0.167)	(0.096)
ln(*VIX*)	0.792**	1.218***	-0.115
	(2.200)	(3.310)	(-0.200)
BB	11.770***	13.380***	
	(0.839)	(0.164)	
Observations	408	216	192
Countries	23	19	6
IMF Program Type	All	*Ex-Post*	*Ex-Ante*
Country-IMF Program FE	✓	✓	✓
Currency-Issuance FE	✓	✓	✓
Month-Year FE	✓	✓	✓
Adjusted R^2	0.872	0.874	0.938

Robust standard errors clustered at the country-program type-level are reported in parentheses.
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

4. Robustness checks

In our first robustness check, we test whether our baseline results are robust to including a less parsimonious set of controls. Table 6, augments the baseline model with five governance indicators (voice and accountability, regulatory quality, rule of law, political stability, government effectiveness, and control of corruption, all sourced from the World Bank's World Governance Indicators), a measure of coincidence of voting with the US in the United Nations (we build the indicators using the results of non-unanimous votes, data on UN voting are from Fjelstul et al., 2025), government fractionalization to proxy for government stability (the data are from Scartascini et al., 2021), two dummies that take value one during banking and currency crises (the data are from Müller et al., 2025), a dummy that takes value one if the country defaulted in the previous ten years (we build this dummy using the updated data from Asonuma and Trebesch, 2016), the current account balance over GDP and the debt to GDP ratio (sourced from World Bank data and IMF World Economic Outlook database).

Most of these variables are not statistically significant and when they are significant, they tend to have the expected sign. Higher levels of voice and accountability and rule of law are associated with lower borrowing costs and so is a larger current account surplus (or a lower deficit), banking crises and government fractionalization are associated with higher borrowing costs. The only puzzling result is that we find that higher debt levels are negatively associated with borrowing costs.

More important for our purposes, our finding that IMF programs are associated with lower borrowing costs and that the effects are larger for ex-post programs is robust to augmenting or baseline model with this rich set of controls.

Another potential issue with our estimate is that our six-month window might be longer than the negotiation period.[14] If this were the case, we would be including bonds issued before the start of the negotiation. This is indeed a possibility as Gehring and Lang (2020) find that, in their sample of countries, negotiations have an average length of 4.3 months. In our sample the median length of the negotiation period is about 5 months and the average length is about 6.5 months (see Fig. A1). When we exclude precautionary

[14] We would like to thank an anonymous referee for raising this point.

Table 6
IMF Programs and Borrowing Costs Additional Controls. This table reports a set of regressions where the dependent variable is the bonds' coupon, and the explanatory variables are a dummy that takes value one after the onset of the program, two dummies that separate ex-ante and ex post programs, the log bond maturity, GDP per capita, total number of IMF programs in a given country, the log of the VIX index, five governance indicators (voice and accountability, regulatory quality, rule of law, political stability, government effectiveness, and control of corruption), a measure of coincidence of voting with the US in the United Nations, government fractionalization, two dummies that take value one during banking and currency crises, a dummy that takes value one if the country defaulted in the previous ten years, the current account balance over GDP, the debt to GDP ratio, and a dummy that takes value one for the Ecuador buy-back bond. All regressions include country-program type, currency of issuance, and month-year fixed effects. Columns 1 and 3 include all bonds, column 2 excludes the Ecuador buy-back bond, column 4 only includes bonds issued around ex-post programs, and column 5 only includes bonds issued around ex-ante programs.

	(1)	(2)	(3)	(4)	(5)
IMF	-0.984***	-0.984***		-5.413***	-0.0329
	(0.275)	(0.274)		(0.0878)	(0.458)
IMF Ex Post			-1.122*		
			(0.614)		
IMF Ex ante			-0.880***		
			(0.245)		
ln(*MAT*)	1.114***	1.114***	1.109***	1.309***	0.963***
	(0.120)	(0.120)	(0.115)	(0.144)	(0.0853)
NP	0.0846	0.0846	0.0594	2.085***	-0.773*
	(0.246)	(0.245)	(0.227)	(0.0917)	(0.394)
GDP PC	0.00936	0.00936	0.0149	6.235***	-0.375***
	(0.0400)	(0.0400)	(0.0429)	(0.110)	(0.0803)
ln(*VIX*)	0.414	0.414	0.43	1.218***	-0.0314
	(0.445)	(0.444)	(0.436)	(0.387)	(0.264)
Voice & Acc	-4.144**	-4.144**	-3.879**	-28.16***	-36.38**
	(1.792)	(1.789)	(1.678)	(0.707)	(6.689)
Reg. Qual.	0.783	0.783	0.892	-91.33***	11.95**
	(1.550)	(1.548)	(1.613)	(2.674)	(4.329)
Rule of Law	-7.933***	-7.933***	-8.307***	-139.5***	-1.418
	(2.558)	(2.555)	(2.729)	(3.041)	(2.434)
Pol. Stab.	1.035	1.035	1.112	8.791***	-2.063
	(0.727)	(0.726)	(0.774)	(0.137)	(2.135)
Gov. Effect.	3.094**	3.094**	2.932**	15.41***	-9.868*
	(1.234)	(1.232)	(1.099)	(0.550)	(4.356)
Contr. Corr.	1.087	1.087	1.090	128.7***	16.29***
	(1.539)	(1.537)	(1.534)	(3.126)	(1.987)
Coinc with US	-4.657	-4.657	-4.329	-48.18***	47.12**
	(5.833)	(5.825)	(5.676)	(1.032)	(18.32)
Gov. Fract.	3.480***	3.480***	3.515***	13.69***	-15.18**
	(0.884)	(0.883)	(0.993)	(0.396)	(5.475)
Curr. Crisis	-0.442	-0.442	-0.492	3.820***	1.055
	(0.341)	(0.340)	(0.432)	(0.571)	(0.801)
Bank. Crisis	3.882***	3.882***	3.701***	21.73***	
	(0.720)	(0.720)	(0.562)	(0.895)	
Def. Hist.	0.290	0.290	0.429	31.84***	
	(0.874)	(0.873)	(0.765)	(0.420)	
Curr. Acc. Bal.	-0.385**	-0.385**	-0.370**	-3.016***	0.140
	(0.142)	(0.142)	(0.145)	(0.0905)	(0.312)
Debt/GDP	-0.0733**	-0.0733**	-0.0703**	-0.888***	0.278*
	(0.0323)	(0.0322)	(0.0308)	(0.0254)	(0.0983)
BB	11.69***		11.88***	16.57***	
	(0.581)		(0.863)	(0.141)	
Observations	408	407	408	216	192
Countries	23	23	23	19	6
Type of IMF Program	All	Excl. BB	All	Ex-Post	Ex-Ante
Country-Program Type FE	✓	✓	✓	✓	✓
Currency-Issuance FE	✓	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓	✓
Adjusted R^2	0.884	0.879	0.884	0.905	0.942

Robust standard errors clustered at the country-program type-level are reported in parentheses.
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

Table 7
IMF Programs and Borrowing Costs different estimation windows. This table reports a set of regressions similar to those of Column 1 of Table 2 (also reported in column 1 of this table for ease of comparison), but with shorter estimations windows. Specifically, column 2 uses and 5-month estimation window, column 3 a 4-month estimation window and column 4 a 3-month estimation window.

	(1)	(2)	(3)	(4)
IMF	-0.723**	-1.202*	-1.726**	-2.651*
	(0.318)	(0.663)	(0.783)	(1.496)
ln(*MAT*)	1.029***	1.037***	1.135***	1.253***
	(0.101)	(0.108)	(0.128)	(0.141)
NP	0.265	0.496	0.175	-0.712
	(0.228)	(0.477)	(0.406)	(0.582)
GDP PC	-0.0898**	-0.0867*	-0.199*	-0.613*
	(0.0242)	(0.0409)	(0.0920)	(0.222)
ln(*VIX*)	0.539	0.516	1.524	0.872
	(0.439)	(0.412)	(0.865)	(0.646)
BB	10.45***	13.35***	12.43***	
	(0.330)	(2.702)	(2.395)	
Observations	408	342	273	213
Countries	23	23	22	22
Before/After Window (in months)	6	5	4	3
IMF Program Type	All	All	All	All
Country-IMF Program FE	✓	✓	✓	✓
Currency-Issuance FE	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓
Adjusted R^2	0.842	0.847	0.860	0.909

Robust standard errors clustered at the country-program type-level are reported in parentheses.
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

(ex-ante) programs, the median length is close to four months and the average length seven months.[15] To reduce the risk of including bonds issued before the beginning of the negotiation process, we re-estimate or baseline regression with shorter windows. Table 7 shows that our results are robust to using 5-, 4-, and 3-months windows. If anything, the point estimates of the IMF program dummy become larger, albeit less precisely estimated because the sample of bonds included drops rapidly as the window becomes smaller.

Next, we compare SDR access to that of peer countries (defined as countries with GDP per capita which is no more than 10 percent different from that of the studied countries). Specifically, $\widetilde{SDR}_{i(p),t(y)}$ is now defined as the difference between SDR access of country i and average SDR access of countries with similar GDP per capita. Table 8 shows that our results are robust to this alternative definition of $\widetilde{SDR}_{i(p),t(y)}$.

We also use the model of Table 2 but replace bonds issued by countries under an IMF program with those issued by similar countries in the same time window.[16] The results of this placebo exercise (Table 9) confirm that we are not picking up some generalized trend in borrowing costs that happens around the approval of IMF programs. We also pool bonds issued by program and non-program countries and estimate the following model:

$$C_{b(i,p,\ x),t(y)} = \alpha IMF_{i(p),t(y)} + IMF_{i(p),t(y)} \times Program_{i(p),t(y)}\left(\eta + \lambda\widetilde{SDR}_{i(p),t(y)}\right) + \tag{4}$$

$$+ \beta\ln\left(MAT_{b(i,p,x),t}\right) + \theta\ln\left(VIX_{t(y)}\right) + \omega BB_{b(i,x),t} + \mu_{i,p} + \xi_x + \tau_{m(y)} + \varepsilon_{b(i,p,\ x),t(y)}$$

[15] For the periods 2002-2015, we use negotiation length data which were kindly shared with us by Kay Gehring and Valentin Lang, for the period 2015-2022 we coded negotiation length following a strategy like that of Gehring and Lang (2020). We were able to find information for 48 of the 68 arrangements included in our dataset. As it is impossible to find the exact dates for negotiations linked to the renewal of FCL arrangements, we assumed that these renewals were agreed six months before the end of the previous arrangement.

[16] For instance, Egypt had a program approved on 11 November 2016. We replace Egypt with non-program countries with a similar GDP per capita at the time of program and that issued bonds around 11 November 2016.

Table 8
Borrowing Costs and IMF Program Size Relative to Peer Borrowing Countries. This table reports a set of regressions where the dependent variable is the bonds' coupon, and the explanatory variables are a dummy that takes value one after the onset of the program (*IMF*), the interaction between IMF and the difference between program size and average program size of comparable countries ($IMF \times \widetilde{SDR}$), the log bond maturity (ln(*MAT*)), the log of the VIX index (ln(*VIX*)), and a dummy that takes value one for the Ecuador buy-back bond (*BB*). All regressions include country-program, currency of issuance, and month-year fixed effects. Column 1 includes all bonds, column 2 only includes bonds issued around ex-post programs, and column 3 only includes bonds issued around ex-ante programs.

	(1)	(2)	(3)
IMF	-0.383	-1.101***	-0.100
	(0.847)	(0.314)	(0.444)
$IMF \times \widetilde{SDR}$	-0.403***	-1.037***	0.087
	(0.136)	(0.078)	(0.226)
ln(*MAT*)	1.195***	1.309***	0.959***
	(0.116)	(0.167)	(0.0963)
ln(*VIX*)	0.942**	1.218***	-0.109
	(0.363)	(0.368)	(0.598)
BB	11.600***	11.920***	
	(0.835)	(0.263)	
Observations	408	216	192
Countries	23	19	6
Type of IMF program	All	*Ex-Post*	*Ex-Ante*
Country-IMF Program FE	✓	✓	✓
Currency-Issuance FE	✓	✓	✓
Month-Year FE	✓	✓	✓
Adjusted R^2	0.870	0.874	0.910

Robust standard errors clustered at the country-program type-level are reported in parentheses.
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

Table 9
Placebo of Peer Non-Borrowing Countries. This table reports the placebo regressions described in the text. The explanatory variables are a dummy that takes value one after the onset of the program (*IMF*), the log bond maturity (ln(*MAT*)), and the log of the VIX index (ln(*VIX*)). Columns 1, 3 and 5 include country-program type fixed effects, while columns 2, 4 and 6 include country-program fixed effects. All regressions include currency of issuance, and month-year fixed effects. Columns 1 and 2 include all peer countries that issued bonds around IMF programs, columns 3 and 4 only include bonds issued around ex-post programs, and columns 5 and 6 only include bonds issued around ex-ante programs.

	(1)	(2)	(3)	(4)	(5)	(6)
IMF	0.0578	-0.473	-0.738	-0.178	-0.166	-0.985
	(0.200)	(0.291)	(0.464)	(0.214)	(0.381)	(0.805)
ln(*MAT*)	0.626**	0.793***	0.863***	0.887***	0.415	0.659***
	(0.179)	(0.132)	(0.233)	(0.173)	(0.282)	(0.237)
GDP PC	-0.078		-0.542***		-0.198*	
	(0.060)		(0.102)		(0.105)	
ln(*VIX*)	0.759	0.707	0.619	0.479	1.977	2.096
	(1.234)	(0.608)	(0.813)	(0.476)	(1.477)	(1.263)
Observations	442	442	266	266	176	176
Countries	25	25	18	18	17	17
IMF Program Type	All	All	Ex-Post	Ex-Post	Ex-Ante	Ex-Ante
Country-Program Type FE	✓	x	✓	x	✓	x
Country-IMF Program FE	x	✓	x	✓	x	✓
Currency-Issuance FE	✓	✓	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.637	0.612	0.747	0.639	0.677	0.632

Robust standard errors clustered at the country-program type-level are reported in parentheses.
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

Table 10
Borrowing Costs in Program and Non-Program Countries. This table reports a set of regressions where the dependent variable is the bonds' coupon, and the explanatory variables are a dummy that takes value one after the onset of the program for both program and non-program comparable countries (*IMF*), a dummy that takes value one for program countries (*Program*), the interaction between IMF and program and the triple interaction between IMF, program and program size ($IMF \times Program \times \widetilde{SDR}$), the log bond maturity (ln(*MAT*)), the log of the VIX index (ln(*VIX*)), and a dummy that takes value one for the Ecuador buy-back bond (*BB*). All regressions include country-program, currency of issuance, and month-year fixed effects. Columns 1 and 2 include all bonds, column 3 only includes bonds issued around ex-post programs, and column 4 only includes bonds issued around ex-ante programs.

	(1)	(2)	(3)	(4)
IMF	-0.030	-0.044	-0.034	-0.659
	(0.249)	(0.241)	(0.267)	(0.429)
$IMF \times Program$	-0.585**	0.272	0.082	-1.266**
	(0.280)	(0.375)	(0.809)	(0.495)
$IMF \times Program \times \widetilde{SDR}$		-0.218**	-0.593**	0.361***
		(0.105)	(0.294)	(0.106)
ln(*MAT*)	0.955***	0.975***	1.122***	0.792***
	(0.096)	(0.098)	(0.141)	(0.109)
ln(*VIX*)	-0.086	0.007	-0.390	1.412**
	(0.393)	(0.375)	(0.450)	(0.583)
BB	12.000***	12.000***	13.580***	
	(0.443)	(0.443)	(0.807)	
Observations	850	850	482	368
Countries	48	48	37	23
IMF Program Type	All	All	Ex-Post	Ex-Ante
Country-IMF Program FE	✓	✓	✓	✓
Currency-Issuance FE	✓	✓	✓	✓
Month-Year FE	✓	✓	✓	✓
Adjusted R^2	0.700	0.704	0.736	0.793

Robust standard errors clustered at the country-program type-level are reported in parentheses.
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

Where $C_{b(i,p,\ x),t(y)}$ is the coupon of bonds issued around IMF programs by both program and non-program comparable countries, $IMF_{i(p),t(y)}$ is a dummy that takes value one after the onset of the program and $Program_{i(p),t(y)}$ is a dummy that takes value one for the program country. All other variables are defined as in Eq. (3).[17]

In Eq. (4), the coefficient η shows the post-program difference in borrowing costs between countries that are under an IMF program and similar countries that are not under a program. Column 1 of Table 10 estimates the model without the triple interaction and shows that being in an IMF program leads to a reduction in borrowing costs. When we control for program size, we corroborate our previous finding that larger programs are associated with lower borrowing costs (column 2 of Table 7) and that this effect is driven by ex-post programs (column 3 of Table 7). For ex-ante programs, instead, we find a reduction in borrowing costs which is independent of program size (column 4).

We also test whether our results vary with maturity size (i.e., whether the impact of the IMF program differs for bonds with longer versus shorter maturities) but find no evidence of such heterogeneity.

5. Conclusions

This paper contributes to the literature which examines the catalytic finance effects of IMF programs. We investigate whether IMF programs, with both ex-ante and ex-post conditionality, facilitate market access by lowering borrowing costs in the primary bond market. We contribute to the literature by using a difference-in-difference identification strategy which, within our sample, mitigates concerns about selection into the program.

We find a statistically and economically significant reduction in borrowing costs associated with the presence of an IMF program.

[17] Note that country-program fixed effects absorb the effects of $Program_{i(p),t(y)}$, $\widetilde{SDR}_{i(p),t(y)}$ and their interaction $Program_{i(p),t(y)} \times \widetilde{SDR}_{i(p),t(y)}$. Moreover, given that *SDR* takes value zero for non-program countries, the triple interaction $IMF_{i(p),t(y)} \times Program_{i(p),t(y)} \times \widetilde{SDR}_{i(p),t(y)}$ absorbs the double interaction $IMF_{i(p),t(y)} \times \widetilde{SDR}_{i(p),t(y)}$.

Baseline estimates indicate that, on average, the coupon of bonds issued six months post-program initiation is 70 basis points lower than the coupon of bonds issued six months before. When distinguishing between ex-ante and ex-post programs, we observe a more pronounced effect in ex-post programs (100 basis points versus 50 basis points). Still, the percentage reduction in borrowing costs remains close to 15 percent in both cases.

We also study the effect of program size. Pooling all programs together, we find that borrowing costs decrease with program size. The point estimates indicate a 23-basis point reduction for every one percent increase in program size relative to GDP. The effect is larger for ex-post programs, where a one percent increase in program size corresponds to a 100-basis point reduction in borrowing costs. For ex-ante programs, we find the opposite result. Although precautionary programs consistently reduce borrowing costs on average, the effect is not statistically significant for large programs.

Our findings have important policy implications. First, they show that ex-ante conditionality, rather than having a negative stigma effect, is interpreted by financial markets as a positive signal. However, the size of the program needs to be calibrated carefully, as very large ex-ante programs appear to be less effective than smaller ones. Second, they show that ex-post programs are effective in restoring market confidence in countries that maintain continuous market access (our paper does not provide evidence on countries that lost market access immediately before the onset of a program). In this case, larger programs have a strong signaling effect, with larger programs being associated with a sharper reduction in borrowing costs. This latter result has important implications for the IMF's Exceptional Access Policy, first adopted in September 2002 and subsequently revised in 2009, 2010, and 2016.

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Supplementary materials

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