

Supplementary Appendix: Why Hide? Africa’s Unreported Debt to China

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A Hidden debt measure

Hidden debt is measured by comparing estimates of debt to China from the World Bank Debtor Reporting System ([World Bank Debtor Reporting System, 2021](#)) and the China’s Overseas Lending Database constructed by [Horn et al. \(2021\)](#). Hidden debt H is defined as the *hidden share* of a country’s total debt to China. This is measured by the difference between HRT and World Bank DRS estimates of outstanding debt to China, divided by the HRT estimate.

$$H = \frac{HRT \text{ debt to China} - DRS \text{ debt to China}}{HRT \text{ debt to China}}$$

How confident can we be that comparing HRT and DRS data will measure debt that is hidden from the IMF and World Bank? DRS loan-level data is confidential and cannot be included here at a granular level, and [Horn et al. \(2021\)](#) is only available at the country-year level. Thus, I evaluate comparability of these two data sources based on their stated scopes and data collection methodologies.

Debtor Reporting System

The DRS is unique among other sovereign debt data repositories in that it has a wide scope that aims to capture all of low-income countries’ external public and private publicly-guaranteed debt. Understanding the scope of the DRS is crucial for my estimates of hidden debt. If the hidden portion estimated by HRT is in fact credit that does not fall under the scope of DRS reports, then it is not hidden from IFIs, but rather outside of their interest.

I look at the Debtor Reporting System Manual to determine exactly which types of credit borrowers are expected to report to IFIs. [Figure 1](#) shows the reporting form that borrowing countries must submit quarterly, and includes all bilateral, multilateral, and private loans both from private banks and in the form of bond issues, as well as export credits, with a maturity of at least 1 year ([World Bank Group, 2013](#), p.7-10). For each loan, the borrowing

country must specify the borrowing agency (e.g. central government, local government, private entity with explicit public guarantee) and the creditor government *and* agency (e.g. China/China Development Bank, China/state owned enterprise). If China disburses official credit through a Chinese SOE to a borrowing country, this should be included in reports the DRS. Likewise, if the China disburses official credit *to* a borrowing country's SOE, this must also be included in DRS reports.

Horn et al. (2021): China's Overseas Lending

I then look at the data collection methodology outlined in [Horn et al. \(2021\)](#) to determine whether the authors include loans in their estimates that fall outside of the DRS scope, and would be irrelevant to my hidden debt analysis. HRT argue that that their data is directly comparable to the DRS, and measure hidden debt “by comparing our estimates to unpublished data from the World Bank’s Debtor Reporting System, which is the key building block underlying the International Debt Statistics as well as related public databases at the IMF” ([Horn et al., 2021](#), p.7). Correspondence with the authors confirmed that Chinese loan data was included in the dataset based on the same criteria used by the DRS; namely, all official credit originating from the Chinese government (including loans disbursed Chinese policy banks and state-owned enterprises) and issued to another sovereign government (including loans issued to state-owned enterprises and sub-national governments in the recipient state, and export credits).

Based on these methodologies, I am confident that both the DRS and HRT data attempt to capture the same concept of sovereign debt owed to China, and that direct comparison of the two sources yields estimates of debt that is hidden from the DRS.

WORLD BANK DEBT REPORTING SYSTEM
FORM 1: DESCRIPTION OF INDIVIDUAL EXTERNAL PUBLIC DEBT AND PRIVATE DEBT
PUBLICLY GUARANTEED

1. Reporting Country	2. Debt No.	2a. Debt No. in Reporting Country (if different)
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3. Name of Borrower 4. Type of Borrower (mark one) ☐ 1. Central government ☐ 2. Central bank ☐ 4. Local government ☐ 6. Public Corporation ☐ 7. Mixed enterprise ☐ 8. Official development bank ☐ 9. Private 5. Name of Guarantor	12. Name of Lender 12a. Creditor Guaranty Agency 13. Creditor Country 14. Type of Creditor (mark one) ☐ 1. Exporter ☐ 2. Private bank or other financial institution ☐ 4. International organization ☐ 5. Government or public agency ☐ 6. Bond ☐ 8. Nationalization
6. Budget Financed? ☐ Yes ☐ No 7. Economic Sector and Purpose 8. Type of Agreement (mark one) ☐ 0. Normal loan ☐ 1. Debt refinancing ☐ 2. Debt rescheduling ☐ 3. Other (describe in Notes)	15. Commitment Date 16. Amount of Commitment _____ of which 1. _____ rescheduled principal arrears 2. _____ rescheduled interest arrears 3. _____ rescheduled maturities 4. _____ rescheduled interest 5. _____ rescheduled short term 6. _____ resch. private non-guaranteed debt. 17. Currency in Which 1. Amount is reported _____ 2. Debt is repayable _____
9. Principal Payments 1. Pattern of Repayments (mark one) ☐ 1. Equal payments ☐ 2. Annuity ☐ 3. One lump sum ☐ 4. Other (provide schedule on Form 1A) 2. Repayment Based on (mark one) ☐ Total commitment ☐ Each drawing 3. If Repayment is Based on Drawings a. No. of months from drawing to first principal repayment: _____ b. No. of principal payments on each drawing: _____	18. Type of Interest or Base ☐ 1. Interest free ☐ 2. Interest included in principal ☐ 3. Fixed rate/rates ☐ 4. Variable rate/rates ☐ 5. Other (Form 1A required) If rates are variable give base 6. 1st variable base _____ 7. 2nd variable base _____ 19. Interest Rates or Margins 1. 1st fixed rate _____% 3. 2nd fixed rate _____% 2. 1st variable margin _____% 4. 2nd variable margin _____% 20. Interest Payment Dates 1. First _____ 2. Final _____ 3. No. of payments per year _____ 4. For items 19.3 or 19.4 above, give dates on which rates take effect: _____
10. Principal Repayment Dates 1. First _____ 2. Final _____ 3. No. of payments per year _____ 11. Consolidation Period From _____ To _____ (Fill in column 3 of Forms 1A with amounts rescheduled each year)	21. Commitment Charge (rate %) _____ 22. Notes

Figure 1: Debtor Reporting System loan disclosure form. Submitted quarterly by borrowing countries to the World Bank and IMF.

B Summary statistics

Table 1: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Hidden proportion of debt to China	666	0.341	0.353	0.000	1.000
External debt / GDP	684	39.230	28.895	1.181	159.468
Debt to China / GDP _n	684	4.169	5.891	0.000	52.110
distance.threshold.abs	425	24.736	23.870	0.100	153.000
Threshold	425	2.875	0.908	0.095	5.037
IMF Program	763	0.570	0.495	0	1
GDP per capita	755	2,330.953	3,301.140	194.873	20,512.940
GDP per capita (log)	755	7.098	1.065	5.272	9.929
GDP (billion USD)	763	27.272	67.325	0.202	568.500
GDP (billion USD, log)	737	2.585	1.172	0.532	6.143
Debt to IMF / GDP	641	2.674	2.488	0.053	14.157
Debt to World Bank / GDP	702	0.128	0.141	0.000	0.932
SCI score	589	59.015	12.835	26.111	93.333
Sub-national taxation	738	0.244	0.430	0	1
Above threshold	763	0.242	0.429	0	1
Debt threshold	443	36.756	7.285	27	56
Threshold = 30	763	0.271	0.445	0	1
Threshold = 40	763	0.219	0.414	0	1
Threshold = 50	763	0.084	0.277	0	1
CPIA budget management score _t	457	3.059	0.652	1.000	4.500
WGI effective governance score	721	-0.743	0.629	-2.484	1.057
China signaled support	546	0.347	0.409	-0.158	2.154
US signaled support	546	-0.435	0.357	-0.908	0.801
Chinese SOE involvement	343	0.100	0.272	0.000	1.000
Borrower SOE involvement	439	0.065	0.227	0.000	1.000
Borrower SOE without guarantee	413	0.960	0.162	0.000	1.000
Total past IMF loans	677	5.950	3.590	0	13
Total past IMF interruptions	677	4.154	2.547	0	11
Debt management office	378	0.497	0.501	0	1
Average maturity	702	2.151	0.101	2.000	2.514
Total commitments, all creditors (billion USD)	663	0.885	3.256	0.000	74.144
Hidden share of Chinese loan commitments	763	0.244	0.406	0.000	1.000
IMF liquidity ratio (log)	763	6.031	0.610	4.970	7.109
IMF liquid resources (log)	763	12.262	0.595	11.493	12.985
IMF probability	763	0.341	0.341	0.000	1.000

C Instrumental variable approach

I use the compound instrument proposed by [Lang \(2021\)](#).¹ Entrance into an IMF loan program is instrumented via the interaction between a country’s recidivism, *IMFprobability*, and the IMF’s global liquidity, *IMFliquidity*. *IMFprobability* is defined as the proportion of years in the observation period (2000-2017) up to year t that each country was subject to an IMF program for at least 5 months. *IMFprobability* is calculated using IMF loan enrollment dates from MONA. *IMFliquidity* is measured using the natural log of the IMF liquidity ratio (value of IMF liquid resources divided by liquid IMF liabilities), using data from [Lang \(2021\)](#).²

This compound instrument follows a difference-in-difference logic; the effect of IMF program participation on hidden debt is compared across a group of countries with a high likelihood of participation and a group of countries with a low likelihood of participation, as IMF liquidity changes.

To serve as a valid instrument, this variable must satisfy two criterion. First, it must be relevant, meaning it is correlated with IMF program assignment holding other exogenous variables constant (). This criterion is tested below. Second, it must satisfy the exclusion restriction, meaning it must only affect the outcome (hidden debt) via participation in an IMF loan program. This is plausible; there are no theoretical expectations that IMF liquidity has an independent effect on a government’s debt reporting. Furthermore, the difference-in-difference set-up means that the exclusion restriction would only be violated if IMF liquidity endogenously affected hidden debt *differently* across countries with different probabilities of participating in an IMF program. While the exclusion restriction cannot be directly tested,

¹First proposed in a working-paper version in 2016.

²Using the 2022 update of the dataset, extended from 2013 to 2021 post-publication. Available at <https://sites.google.com/view/valentinlang/data?authuser=0>

I offer additional evidence below that it is satisfied.

C.1 2SLS specification and first-stage results

The compound instrument is somewhat complicated here by the fact that the endogenous regressor (*IMFprogram*) enters the model in an interaction term. I follow the recommendations of [Bun and Harrison \(2019\)](#) regarding the use of instrumental variables in estimating conditional effects. Both the additive term (*IMFprogram*) and the interaction term (*Threshold * IMFProgram*) may be endogenous, and so an instrument must be applied to both terms. This means that the first stage must include an interaction between the instrument and the treatment variable *Threshold*; as the IV is itself an interaction term, this enters the first stage as a triple interaction. The two instruments are thus the triple interaction between distance to the threshold, IMF probability, and IMF liquidity, and the interaction between IMF probability and IMF liquidity, shown in bold in the first stage equation below.

First stage equation:

$$\begin{aligned} IMFprogram_{i,t} = & \alpha_1(\mathbf{Threshold}_{i,t} * \mathbf{IMFprobability}_{i,t} * \mathbf{IMFliquidity}_t) + \\ & \alpha_2(\mathbf{IMFprobability}_{i,t} * \mathbf{IMFliquidity}_t) + \alpha_3(IMFprobability_{i,t} * Threshold_{i,t}) + \\ & \alpha_4(IMFliquidity_t * Threshold_{i,t}) + \alpha_5 IMFprobability_{i,t} + \alpha_6 IMFliquidity_t + \\ & \alpha_7 Threshold_{i,t} + \alpha_8 Threshold_{i,t}^2 + \mathbf{X}'_{i,t} \alpha_7 + \delta_i + \tau_t + v_{i,t} \end{aligned}$$

As [Lang \(2021\)](#) discusses, a key feature of this shift-share instrument is that only the interaction term itself (in this case, the double and triple interactions) are used as the source of exogenous variation. The constituent terms of the compound instrument are included in both the first and second stage regressions.

The first-stage results are shown in Table 2. Model 1 shows the results of the first stage estimating *IMFprogram*, while model 2 shows the results of the first stage estimating *IMFprogram * Threshold*. The interaction term *Threshold * IMFliquidity * IMFProbability* is the exogenous source of variation.

Table 2: 2SLS First stage

	<i>Dependent variable:</i>	
	IMF program	IMF program <i>x</i> Distance to Threshold
	(1)	(2)
Threshold	−0.700*** (0.245)	−0.754 (0.787)
IMF liquidity ratio (log)	−0.497*** (0.185)	−1.300** (0.596)
IMF probability	−2.429 (1.575)	−6.278 (5.058)
Threshold:IMF liquidity ratio (log)	0.104*** (0.040)	0.185 (0.127)
Threshold:IMF probability	1.012** (0.469)	2.760* (1.506)
IMF liquidity ratio (log):IMF probability	0.562** (0.245)	1.146 (0.788)
Threshold:IMF liquidity ratio (log):IMF probability	−0.151** (0.074)	−0.301 (0.239)
GDP per capita (log)	1.538*** (0.286)	3.281*** (0.920)
GDP (billion USD, log)	−1.002*** (0.265)	−1.595* (0.851)
Debt to China / GDP	−0.001 (0.003)	−0.005 (0.010)
Debt to World Bank / GDP	0.305 (0.250)	1.014 (0.803)
External debt / GDP	−0.0003 (0.001)	−0.003 (0.005)
SCI score	−0.005** (0.002)	−0.016*** (0.006)
Sub-national taxation	0.665*** (0.194)	0.632 (0.622)
Debt to IMF / GDP	0.023** (0.009)	0.089*** (0.030)
Above threshold	−0.056 (0.036)	−0.038 (0.114)
Year fixed effects	Yes	Yes
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	384	384
R ²	0.819	0.853
Adjusted R ²	0.786	0.826
K-P weak instrument (p-value)	0.000	0.000
K-P weak instrument (F-stat)	10.976	33.982

Note:

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

The first stage results are used to estimate the second stage equation below, which produces the results shown in model 3 of Table 1 in the manuscript.

Second stage:

$$H_{i,t} = \widehat{Threshold}_{i,t}\beta_1 + \widehat{IMFprogram}_{i,t}\beta_2 + (\widehat{Threshold}_{it} * \widehat{IMFprogram}_{i,t})\beta_3 + \mathbf{X}\beta_{it} + \gamma_t + \epsilon_{it}$$

Kleibergen-Paap weak instrument tests reported in the bottom panel of Table 2 reject the null that the instrument is weak, both when instrumenting for *IMFProgram* and for its interaction with *Threshold*. While there is no statistical test to completely evaluate the exclusion restriction assumption of the 2SLS model, falsification tests can offer an indication of whether or not those assumptions hold.

C.2 Correlation between IMF liquidity, IMF probability, and hidden debt

I first defend the exclusion restriction by showing that IMF liquidity is not correlated with hidden debt. Figure C.2 replicates Figure 2 in Lang (2021) to investigate the exclusion restriction. The exclusion restriction in the compound instrument would be violated if unobserved confounders affect hidden debt differently in countries with different histories of IMF participation. Figure C.2 plots hidden debt on the left axis, split between groups of countries with high (red line), low (blue line), and zero (purple line) average values of IMF probability. IMF liquidity is plotted on the right axis (green solid line). The trends in hidden debt are similar across values of IMF probability, and none is clearly correlated with IMF liquidity. Importantly, Christian and Barrett (2017) demonstrate that the identifying assumption in this type of compound instrument can be violated if some of these trends (in hidden debt) are correlated with the time-varying component of the instrument (IMF liquidity), while other trends are not. This is essentially the parallel trends assumption of a difference-in-difference specification. Crucially, Figure C.2 does not show evidence of heterogeneous trends across different levels of *IMFprobability*. Hidden debt across, zero, low, and high probability borrowers has similar trends throughout the study period, and none of the trends appear to be substantially more correlated with *IMFliquidity*.

The shocks in liquidity seen in the green solid line in Figure C.2 are the product of an exogenous process. As Lang (2021) describes, IMF liquidity is primarily determined by agreements made by the IMF Quota Reviews held every five years, where member states' future commitments to the IMF are scheduled. For example, the spike in liquidity after 2005 shows the increase in member countries' payments following the 12th General Review of Quotas. The timing of this increase is exogenous to hidden debt and economic trends in

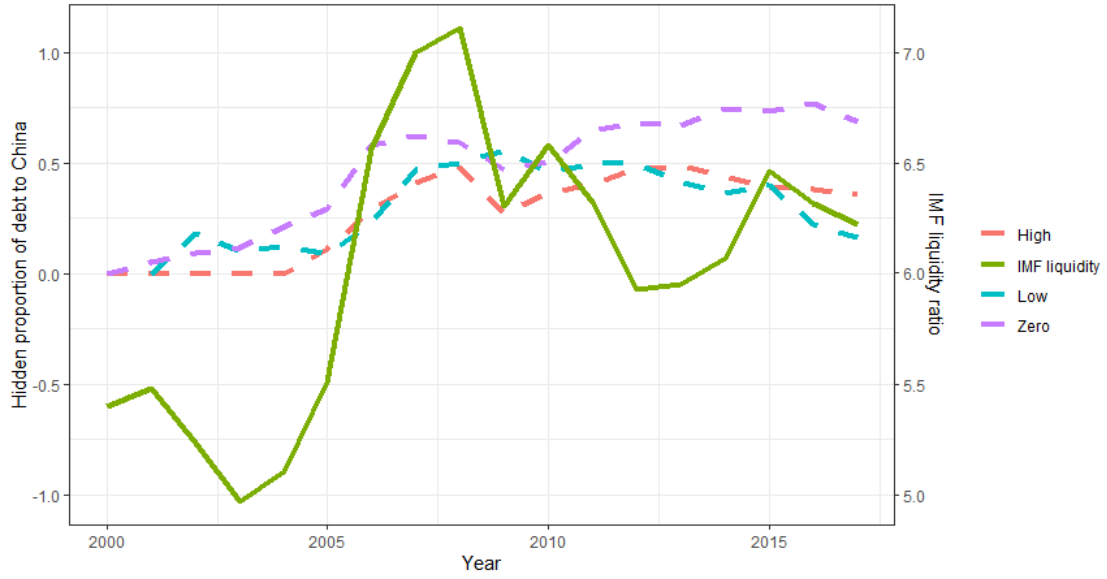


Figure 2: **Temporal variation in IMF liquidity and hidden debt across countries with high, low, or zero IMF probability.** The left axis plots the hidden proportion of debt to China across the sample period. The dashed lines show the cross-country average in each year of the hidden debt proportion for countries with above-median (red), below-median (blue), or zero (purple) values of IMF probability. The right axis plots the natural log of the IMF liquidity ratio (liquid assets divided by liquid liabilities). The solid green line shows the annual liquidity ratio.

individual countries.³

Next, I examine the relevance criteria of the instrument. The Kleinbergen-Paap weak instrument tests help to demonstrate that the instrument is strong and thus provides sufficient information about the assignment of an IMF program. This relevance is based on the strong, positive correlation between the IMF liquidity ratio and the assignment of an IMF program (Kern et al., 2019). Figure C.2 again plots IMF liquidity on the right axis, with the count of new IMF programs (within the 34 Sub-Saharan African countries in the sample) on the left axis. The incidence of new programs appears to vary with IMF liquidity, with both increasing substantially from 2007 to 2010. The Pearson correlation coefficient between *IMFLiquidity* and *IMFprogram* is 0.367 with a p-value of 0.000 (CI: 0.3038, 0.4267).

³Lang (2021) offers extensive evidence that IMF liquidity is not correlated with global economic cycles.

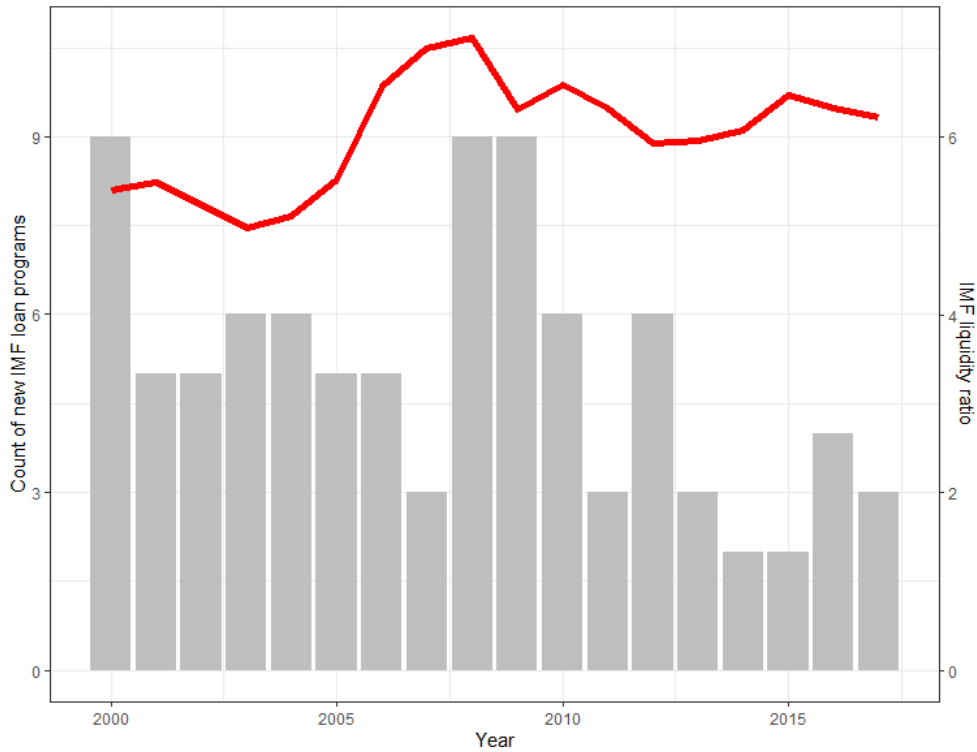


Figure 3: **Temporal variation in IMF liquidity and IMF loan program assignment.** The left axis plots the number of new IMF programs agreed in each year within the 34 sub-Saharan African countries in the sample. The gray bars represent a count of new IMF programs in each year. The right axis plots the natural log of the IMF liquidity ratio (liquid assets divided by liquid liabilities). The solid red line shows the annual liquidity ratio.

C.3 Alternative construction of compound instrument

Next, I test two modifications of the instrumental variable to address issues discussed by [Lang \(2021\)](#). A key concern with this identification strategy may be that IMF liquidity liabilities (the denominator in the IMF liquidity ratio) could be influenced by IMF member states, which would threaten the exclusion restriction if borrowing/repayment is correlated with hidden debt across different levels of IMF probability. While exogenous quota reviews are the primary determinant of IMF liquid assets, the repayment of large loans can cut IMF liabilities and raise the liquidity ratio endogenously. As [Lang \(2021\)](#) notes, Brazil and Turkey repaid significant IMF loans in the early 2000s, which contributed to the surge in the liquidity ratio around 2005 visible in [Figure C.2](#). To address this, I replace the IMF liquidity ratio with a measure of the IMF’s total liquid resources. Removing the denominator, IMF liquid liabilities, from the measure helps to more narrowly focus on the exogenous component of IMF liquidity. Liquid resources are almost completely determined by agreements in quota reviews and are not immediately influenced by governments’ independent decisions to repay or withhold payment to the IMF. While relying only on liquid resources loses important variation in IMF lending decisions driven by changes in liabilities, this conservative approach should allay concerns about endogeneity in the country-constant component of the compound instrument. The results using this adjusted instrument are shown in column 1 panel A in [Table 3](#); the results are robust, and tests in the first stage (panel B for *IMFProgram*, panel C for *ThresholdxIMFProgram*) reject the null that the instrument is weak.

Another adjustment that [Lang \(2021\)](#) proposes concerns the *IMFprobability* component of the compound instrument. Following [Nunn and Qian \(2014\)](#), I replace this time-varying measure of cumulative IMF program participation with a constant value of the share of years in the entire study period that each country was subject to an IMF program. While this introduces some post-treatment bias (some future IMF programs used to instrument for current IMF programs), it captures country-specific probability of participation that is

exogenous to annual changes in hidden debt. The constant *IMFprobability* is measured as such (directly following the construction in [Lang \(2021\)](#)):

$$IMFprobability(constant)_i = \frac{\sum_{T=2000}^{2017} I(IMFProgram_{iT}=1)}{18}$$

Column 2 in Table 3 shows the results using the most conservative instrument, the interaction between IMF liquid resources and the constant *IMFprobability*. Again, the results are robust, and the instrument passes weak instrument tests in the first stages (panels B and C).

Table 3: Alternate IV construction

	<i>Dependent variable:</i>	
	Hidden proportion of debt to China	
	Liquid resources (1)	IMF probability (constant) (2)
Panel A: Second Stage		
Threshold	−0.234*** (0.070)	−0.157** (0.061)
IMFProgram	−0.973*** (0.331)	−0.712*** (0.243)
Threshold x IMFProgram	0.207*** (0.075)	0.136** (0.068)
Panel B: First Stage (DV = IMF program)		
IMF liquid resources x IMF probability	−1.349*** (0.250)	
IMF liquid resources x IMF probability x Threshold	0.263*** (0.073)	
IMF liquid resources x IMF probability (constant)		−3.147*** (0.318)
IMF liquid resources x IMF probability (constant) x Threshold		−0.765*** (0.087)
K-P weak instrument (p-value):	0.000	0.000
K-P weak instrument (F stat):	26.570	38.257
Panel C: First Stage (DV = IMF program x Threshold)		
IMF liquid resources x IMF probability	−1.898** (0.820)	
IMF liquid resources x IMF probability x Threshold	0.127 (0.240)	
IMF liquid resources x IMF probability (constant)		−6.450*** (1.077)
IMF liquid resources x IMF probability (constant) x Threshold		1.487 (2.934)
K-P weak instrument (p-value):	0.000	0.000
K-P weak instrument (F stat):	45.919	44.251
Year fixed effects	Yes	Yes
Debt threshold fixed effects	Yes	Yes
Controls	Yes	Yes
Observations	382	382

Note:

Both specifications include all controls shown in the column 4 of Table 1 in the manuscript, including the constituent components of all interaction terms.

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

D Analysis of hidden annual commitments

I estimate models using hidden flows of new loan commitments rather than hidden stocks of annual debt-to-GDP as the dependent variable. The main dependent variable, hidden share of debt to China, assumed that borrowing governments decide to hide a portion of debt to China in each year. Instead, governments may rather choose to hide an entire loan in the year that it is signed. The ideal estimation to match this data generation process would be to estimate the likelihood that each individual loan is hidden, but DRS confidentiality requirements prevent the reporting of estimates below the country-year level. Instead, I replace the dependent variable (hidden share of outstanding debt) with each country’s hidden share of new Chinese loan commitments in each year.

I reconstruct the dependent variable. Instead of share of outstanding debt to China that is hidden, the DV is now share of annual loan commitments from China that are hidden. This is again measured as the difference between HRT ([Horn et al., 2021](#)) and World Bank DRS estimates ⁴, divided by the HRT estimate.

$$\textit{Hidden commitments} = \frac{\textit{HRT Chinese commitments} - \textit{DRS Chinese commitments}}{\textit{HRT Chinese commitments}}$$

I estimate the effect of *Threshold* and its interaction with *IMFprogram* on the hidden share of Chinese commitments. In addition to the controls included in the main debt burden models, I also control for total new loan commitments from all creditors (private, official, and bilateral), measured in billion USD and log-transformed. Results are shown in Table 4 and follow the same structure as Table 1 in the manuscript. The effect of *Threshold* remains negative but is not significant (columns 1 and 2). However, the interaction term is significant and positive across both the OLS (column 3) and 2SLS (column 4) specifications. Substantively, the interaction term in the 2SLS specification can be interpreted as a 24.5%

⁴This is analogous to the “Commitments, public and publicly guaranteed (COM, current US\$)” series in the International Debt Statistics, the publicly-available version of the aggregate DRS data.

increase in the hidden share of new commitments as reported debt moves 50% closer to the debt threshold and when the government is not engaged in an IMF loan program. When the government is borrowing from the IMF, distance from the threshold has an insignificant effect on the hidden share of new commitments from China.

The sample size in all models is reduced to 247 as governments do not borrow from China in every year. This introduces a complex selection issue as the choice to borrow in a particular year is likely endogenous to the government's incentives to hide debt in that year. Further, the hidden share of debt burdens changes in years when the government does not borrow from China. By restricting the sample to borrowing years, this estimation may miss important variation in hidden debt that governments use to respond to IFI restrictions.

Table 4: Effect of IFI interventions on hidden commitments to China

	<i>Dependent variable:</i>			
	Hidden proportion of annual Chinese commitments			
	<i>OLS</i> (1)	<i>OLS</i> (2)	<i>OLS</i> (3)	<i>2SLS</i> (4)
Threshold	−0.044 (0.042)	−0.037 (0.044)	−0.289*** (0.099)	−0.367* (0.203)
IMF Program		0.046 (0.102)	−0.951** (0.368)	−1.564 (1.055)
Threshold x IMF Program			0.293*** (0.104)	0.354* (0.203)
(log) Total commitments, all creditors (billion USD)	−0.286*** (0.080)	−0.286*** (0.080)	−0.361*** (0.084)	−0.363*** (0.093)
GDP per capita (log)	0.019 (0.065)	0.022 (0.065)	−0.006 (0.065)	−0.014 (0.070)
GDP (billion USD, log)	0.099* (0.057)	0.097* (0.057)	0.124** (0.057)	0.113* (0.061)
Debt to China / GDP	0.003 (0.006)	0.004 (0.007)	0.007 (0.007)	0.008 (0.007)
Debt to World Bank / GDP	−13.891* (7.842)	−13.534* (7.897)	−13.709* (7.776)	−14.595* (8.062)
External debt / GDP	0.005 (0.004)	0.004 (0.004)	0.005 (0.004)	0.006 (0.005)
Sub-national taxation	0.030 (0.092)	0.038 (0.094)	0.007 (0.093)	0.036 (0.103)
SCI score	0.007* (0.004)	0.006 (0.004)	0.006 (0.004)	0.006 (0.004)
Debt to IMF / GDP	−0.002 (0.018)	−0.003 (0.018)	−0.005 (0.018)	−0.010 (0.019)
Above threshold	0.106 (0.079)	0.119 (0.085)	0.122 (0.083)	0.023 (0.141)
IMF liquidity ratio (log)				−0.196 (0.233)
IMF probability				0.409 (0.441)
Year fixed effects	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes
IV	No	No	No	Yes
Observations	247	247	247	247
K-P weak instrument: IMF Program				
F-stat				8.949
P-value				0.000
K-P weak instrument Threshold x IMFProgram:				
F-stat				23.001
P-value				0.000

Note:

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

E Inverse probability weights approach

I use a compound instrumental variables approach in the manuscript to address selection into IMF programs. Here, I take an alternate, Heckman-selection approach and include inverse probability weights (IPW) in my main models. I begin by predicting a country’s IMF program “hazard rate” using the logit estimator proposed by [Nooruddin and Simmons \(2006\)](#) and used in [Hyde and O’Mahony \(2010\)](#). IMF participation is predicted by the incidence of previous IMF loan programs, economic fundamentals, and the Polity IV Project regime score ([Marshall et al., 2002](#)). My country-year observations are then weighted by the inverse probability of IMF program participation, following the method used by [Caselli and Wingender \(2021\)](#). By implementing this weighting strategy, I attempt to build a counterfactual group assuming that receiving an IMF loan is an as-good-as random treatment conditional on covariates that predict the likelihood of loan assignment.

E.1 IMF “hazard rate”

I estimate the probability that a country is under an IMF program, or the “hazard” rate, based on the model of IMF program participation proposed by [Nooruddin and Simmons \(2006\)](#). I follow the model construction used by [Hyde and O’Mahony \(2010\)](#). The dependent variable *Program* takes a value of 1 if a country is under an IMF program that carries fiscal conditions, and 0 otherwise. The independent variables are one-period lags of *IMFprogram*, GDP per capita, the GDP growth rate, the current account balance as % of GDP,⁵ and Polity IV score.⁶ The inclusion of a lagged dummy for IMF program participation accounts for recidivism which is a key determinant of participation in the present period and is frequently used to estimate IMF program selection ([Nooruddin and Simmons, 2006](#); [Stone, 2008](#)). The hazard rate is predicted using a logit estimator:

⁵World Development Indicators (2019)

⁶Marshall et al. (2002)

$$Program_{it} = Program_{it-1}\beta_1 + GDP\ growth_{it-1}\beta_2 + GDP\ per\ capita_{it-1}\beta_3 + \\ Current\ Account_{it-1}\beta_4 + Polity\ IV_{it-1}\beta_5 + \epsilon_{it}$$

The results of the hazard model are shown in Table 5. All independent variables are lagged by one period.

Table 5: IMF “hazard rate” prediction

	<i>Dependent variable:</i>
	IMF program
IMF Program	7.607 (208.674)
GDP (billion USD, log)	−0.096 (0.121)
GDP per capita (log)	−0.357*** (0.138)
GDP growth	0.009 (0.028)
Polity IV	0.015 (0.026)
CAB	0.015 (0.016)
Observations	576
Log Likelihood	−70.836
Akaike Inf. Crit.	155.671
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

This hazard model is used to produce inverse probability weights (IPW) following the method used by [Caselli and Wingender \(2021\)](#). These are used to weight country-year observations in the main results.

E.2 Results using IPW

I re-estimate the main models in table 1 in the manuscript including IPW to account for selection into an IMF program. Results are shown in Table 6. Columns 1 and 3 estimate the *Threshold* and *Threshold * IMFProgram* models without IPW, and columns 2 and 4 estimate them with IPW, respectively.

The effect of *Threshold* remains negative and significant, and is slightly larger in the IPW models. The conditional effect of *Threshold* across entrance into *IMFprogram* is significant and positive across both specifications. Figure 4 plots the marginal effect of distance to the *Threshold* across *IMFprogram*; the left panel plots the marginal effect without IPW, while the right panel plots the marginal effect with IPW. Even when accounting for potential selection, IMF programs reduce the effect of debt thresholds on governments' hidden debt.

Table 6: Main models estimated with and without inverse probability weights

	<i>Dependent variable:</i>			
	Hidden proportion of debt to China			
	(1)	(2)	(3)	(4)
Threshold	−0.042** (0.021)	−0.164*** (0.027)	−0.168*** (0.051)	−0.335*** (0.055)
IMF Program		−0.022 (0.067)	−0.518*** (0.194)	−0.750*** (0.214)
Threshold x IMF Program			0.147*** (0.054)	0.209*** (0.058)
GDP per capita (log)	0.078** (0.033)	0.035 (0.050)	0.065** (0.033)	0.006 (0.050)
GDP (billion USD, log)	−0.036* (0.019)	−0.011 (0.027)	−0.034* (0.019)	−0.011 (0.026)
Debt to China / GDP	0.019*** (0.004)	0.022*** (0.006)	0.019*** (0.004)	0.025*** (0.006)
Debt to World Bank / GDP	0.356 (0.343)	−0.067 (0.466)	0.334 (0.341)	−0.180 (0.459)
External debt / GDP	−0.001 (0.002)	0.004 (0.003)	−0.001 (0.002)	0.003 (0.003)
SCI score	0.0003 (0.002)	0.006* (0.003)	0.0002 (0.002)	0.006** (0.003)
Sub-national taxation	0.253*** (0.044)	0.437*** (0.064)	0.249*** (0.045)	0.455*** (0.063)
Debt to IMF / GDP	−0.007 (0.009)	−0.036*** (0.012)	−0.007 (0.009)	−0.035*** (0.012)
Above threshold	−0.051 (0.043)	−0.031 (0.055)	−0.044 (0.044)	−0.013 (0.054)
Year fixed effects	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes
IPW	No	Yes	No	Yes
Observations	382	344	382	344

Note:

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

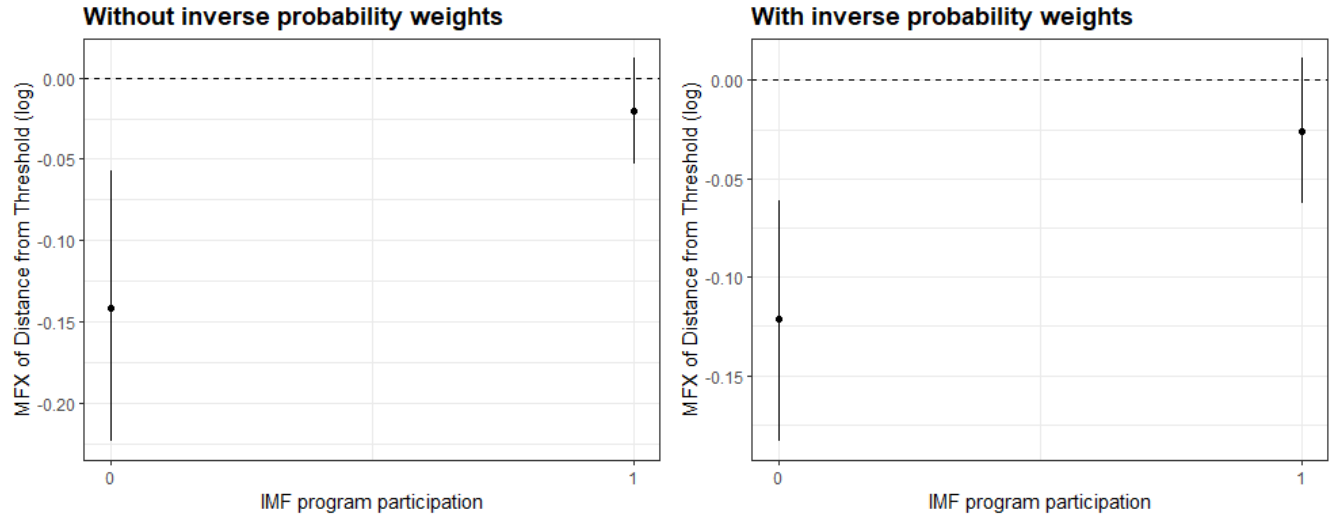


Figure 4: **Marginal effect of Distance from Threshold (log) across IMF Program.** Both panels show the marginal effect of distance from the debt threshold on the hidden debt share, while under an IMF program ($= 1$) and while not under an IMF program ($= 0$). The left panel shows the marginal effect estimated with OLS, while the right panel shows the marginal effect estimated with 2SLS. Dots indicate point estimate of marginal effect, lines indicate 95% confidence intervals.

F Additional controls

I run the main models with the addition of controls for alternate definitions of budget reporting capacity, United States signaled support, China signaled support, and SOE involvement shown in Table 7 and table 8. Column 1 controls for the United States’ signaled support for each country with the latent measure from [McManus and Nieman \(2019\)](#). Column 2 controls for China’s signaled support for each country with the latent measure from [McManus and Nieman \(2019\)](#).

Column 3 substitutes the CPIA Budget Management score for the World Bank World-wide Governance Indicators (WGI)⁷ measure of government effectiveness, which combines survey responses from enterprise, civilians, and local experts on the quality of bureaucracy, competence of civil service, and independence of civil service from political pressures. Column 4 includes the World Bank Statistical Capacity Index ([Bank, 2021](#)) as an alternate measure of budget reporting capacity. TheSCI score is a composite score that rates the capacity, methodology, and timeliness of a government’s official statistics. The index is scaled from 0 to 100, with higher values representing higher capacity to generate accurate official statistics.

Column 5 includes an indicator for the presence of an independent debt management office (DMO) as a DMO can both improve statistical capacity and limit political influence over debt reporting ([Sadeh and Porath, 2020](#)). The indicator is taken from the Collaborative Africa Budget Reform Initiative ([CABRI, 2022](#)) which records whether a government has an official, independent office to manage public borrowing, and the year of establishment. CABRI only assesses DMOs in 23 sub-Saharan African states, resulting in a smaller sample size in this model.

Columns 6 and 7 include measures constructed using the AidData Global Chinese Offi-

⁷[Kaufman and Kraay \(2016\)](#)

cial Finance (version 2.0) loan-level database. This database includes important loan-level information that is excluded or confidential in the DRS, including the borrowing and lending entity involved in each loan (Bluhm et al., 2018). However, AidData includes fewer loans than are reported in the DRS or are included in the HRT data, which results in a more restricted sample in these models.

Column 6 includes a measure for Chinese SOE involvement in the lending process, where SOEs directly and exclusively disbursed loan funds. I take the total value of credit (in current USD) issued by China to a borrowing country each year, and measure the proportion of that credit which is issued through Chinese SOEs (as opposed to Chinese state banks or development corporations).

In Column 7 I include another measure of SOE involvement, namely the share of new credit issued by any Chinese official entity to a borrower’s SOE *without* a sovereign guarantee. Non-guaranteed loans are required to be reported to the DRS, but may be more difficult for governments to accurately report given that the loan is managed independently by the SOE. A large share of non-guaranteed loans to the borrower’s SOEs may make it easier for governments to accidentally misreport loans, rather than intentionally omit them from DRS reports.

Column 8 includes the average maturity of all new commitments (across all creditors, not just China), weighted by the value of each loan. This uses data from the International Debt Statistics (series “Average maturity on new external debt commitments (years)”) (Rucaj et al., 2021). This captures an alternate strategy that governments could engage to prevent new loans from entering the DRS. The DRS only requires governments to report loans with a minimum maturity of 1 year, and so short-term liabilities can be excluded without any illicit activity. Here, the effect of *Threshold* is still significant even when controlling for this maturity measure, which suggests that governments engage in illicit hidden debt separately from (or in addition to) other strategies.

Table 7: Effect of Threshold on hidden debt, additional controls

	<i>Dependent variable:</i>							
	Hidden proportion of debt to China							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Threshold	−0.066** (0.029)	−0.067** (0.029)	−0.042* (0.022)	−0.043** (0.022)	−0.082*** (0.028)	−0.077*** (0.029)	−0.048* (0.028)	−0.046** (0.022)
IMF Program	−0.038 (0.069)	−0.024 (0.070)	−0.017 (0.054)	−0.009 (0.056)	0.102 (0.090)	0.067 (0.073)	0.048 (0.069)	−0.014 (0.056)
GDP per capita (log)	0.065 (0.042)	0.069 (0.042)	0.073** (0.032)	0.072** (0.033)	0.181*** (0.053)	0.050 (0.043)	0.057 (0.041)	0.075** (0.034)
GDP (billion USD, log)	−0.040 (0.026)	−0.048* (0.027)	−0.035* (0.019)	−0.035* (0.019)	0.029 (0.028)	−0.048* (0.028)	−0.018 (0.027)	−0.031 (0.023)
Debt to China / GDP	0.017** (0.007)	0.018** (0.007)	0.018*** (0.004)	0.019*** (0.004)	0.022*** (0.007)	0.005 (0.004)	0.011*** (0.004)	0.019*** (0.004)
Debt to World Bank / GDP	0.358 (0.426)	0.413 (0.429)	0.359 (0.343)	0.336 (0.347)	0.370 (0.448)	0.605 (0.586)	0.251 (0.473)	0.374 (0.344)
External debt / GDP	−0.001 (0.003)	−0.001 (0.003)	−0.001 (0.002)	−0.001 (0.002)	0.002 (0.003)	−0.003 (0.003)	−0.003 (0.003)	−0.001 (0.002)
SCI score	0.0001 (0.003)	0.001 (0.003)			0.001 (0.003)	−0.004 (0.003)	0.0004 (0.003)	0.001 (0.002)
Above threshold	−0.079 (0.062)	−0.094 (0.064)	−0.054 (0.044)	−0.056 (0.044)	−0.137** (0.065)	0.011 (0.059)	−0.034 (0.054)	−0.054 (0.045)
Sub-national taxation	0.256*** (0.058)	0.244*** (0.060)	0.251*** (0.045)	0.244*** (0.045)	0.239*** (0.074)	0.200*** (0.062)	0.217*** (0.059)	0.245*** (0.047)
Debt to IMF / GDP	−0.006 (0.014)	−0.007 (0.014)	−0.007 (0.009)	−0.007 (0.009)	0.017 (0.012)	−0.015 (0.014)	0.005 (0.012)	−0.006 (0.009)
US signaled support	−0.008 (0.081)							
China signaled support		0.063 (0.069)						
WGI effective governance score			0.030 (0.061)					
CPIA budget management score				−0.022 (0.038)				
Debt management office					−0.202*** (0.052)			
Chinese SOE involvement						0.164** (0.082)		
Borrower SOE without guarantee							−0.094 (0.125)	
Average maturity								−0.095 (0.197)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	252	252	382	381	210	208	247	382

Note:

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

Table 8: Effect of Threshold x IMFProgram on hidden debt, additional controls

	<i>Dependent variable:</i>							
	Hidden proportion of debt to China							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Threshold	-0.181*** (0.059)	-0.182*** (0.059)	-0.167*** (0.052)	-0.170*** (0.051)	-0.335*** (0.070)	-0.188*** (0.063)	-0.173*** (0.062)	-0.174*** (0.051)
IMF Program	-0.508** (0.222)	-0.496** (0.222)	-0.515*** (0.195)	-0.520*** (0.194)	-0.798*** (0.246)	-0.407 (0.253)	-0.485** (0.245)	-0.525*** (0.194)
Threshold x IMF Program	0.144** (0.065)	0.144** (0.065)	0.146*** (0.055)	0.150*** (0.055)	0.277*** (0.071)	0.137* (0.070)	0.150** (0.067)	0.150*** (0.055)
GDP per capita (log)	0.047 (0.042)	0.052 (0.042)	0.064** (0.032)	0.058* (0.033)	0.162*** (0.052)	0.044 (0.043)	0.049 (0.041)	0.062* (0.034)
GDP (billion USD, log)	-0.043* (0.026)	-0.050* (0.026)	-0.034* (0.019)	-0.033* (0.019)	0.051* (0.027)	-0.050* (0.028)	-0.019 (0.027)	-0.030 (0.023)
Debt to China / GDP	0.021*** (0.007)	0.021*** (0.007)	0.019*** (0.004)	0.019*** (0.004)	0.029*** (0.007)	0.006 (0.004)	0.012*** (0.004)	0.020*** (0.004)
Debt to World Bank / GDP	0.356 (0.423)	0.414 (0.426)	0.336 (0.341)	0.303 (0.344)	0.191 (0.434)	0.761 (0.587)	0.293 (0.469)	0.350 (0.341)
External debt / GDP	-0.002 (0.003)	-0.002 (0.003)	-0.001 (0.002)	-0.001 (0.002)	0.002 (0.003)	-0.004 (0.003)	-0.003 (0.003)	-0.001 (0.002)
SCI score	-0.0002 (0.003)	0.001 (0.003)			0.00002 (0.003)	-0.004 (0.003)	0.0003 (0.003)	0.0004 (0.002)
Above threshold	-0.060 (0.063)	-0.075 (0.064)	-0.044 (0.044)	-0.046 (0.044)	-0.105 (0.064)	0.019 (0.059)	-0.032 (0.053)	-0.042 (0.045)
Sub-national taxation	0.258*** (0.058)	0.245*** (0.059)	0.249*** (0.044)	0.242*** (0.045)	0.261*** (0.071)	0.200*** (0.062)	0.207*** (0.059)	0.242*** (0.047)
Debt to IMF / GDP	-0.009 (0.014)	-0.009 (0.014)	-0.008 (0.009)	-0.008 (0.009)	0.018 (0.011)	-0.013 (0.014)	0.005 (0.012)	-0.007 (0.009)
US signaled support	-0.006 (0.081)							
China signaled support		0.064 (0.069)						
WGI effective governance score			0.006 (0.061)					
CPIA budget management score				-0.030 (0.038)				
Debt management office					-0.271*** (0.053)			
Chinese SOE involvement						0.157* (0.081)		
Borrower SOE without guarantee							-0.117 (0.125)	
Average maturity								-0.129 (0.196)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	252	252	382	381	210	208	247	382

Note:

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

G Alternative measures of IMF scrutiny

In the main text I use the assignment of IMF loan programs to indicate periods when IFIs increase their scrutiny of borrowing governments' national accounts, following [Hyde and O'Mahony \(2010\)](#). The finding that hidden debt around the DRS threshold decreases during IMF programs indicates that governments strategically reduce hiding when they expect additional scrutiny from IFI. Here, I consider observable implications that should follow if governments are strategically responding to IMF scrutiny.

First, I include additional controls in my main specification to capture aspects of the relationship between the IMF and borrowing governments that could lead to different levels of scrutiny.

- Models 1 and 2 include a count of the total number of loan programs being administered by the IMF in each year. The IMF program burden was counted from the IMF Monitoring of Fund Arrangements (MONA) records. When the IMF faces many simultaneous claims on its resources, it may be less able to strictly monitor national accounts during loan negotiations and compliance evaluations.
- Models 3 and 4 include an indicator of whether a government was engaged in a separate IMF loan program in the previous year. This captures short-term recidivism into IMF programs; governments that needed rapid, repeat intervention from the IMF to resolve a balance-of-payments crisis.
- Models 5 and 6 include a running count of past IMF loan programs within each country. For example, Cabo Verde had completed in 1 IMF loan program prior to the start of the study period in 2000; the running count increased to 2 in 2003 after the country completed its 2nd program. IMF program dates are taken from the MONA records. This more extended measure of recidivism captures “repeat offenders” that may attract increased scrutiny from IMF staff.

- Models 7 and 8 include a running count of past IMF loan programs that were temporarily or permanently interrupted. This means that either the borrowing government or IMF staff stopped program activity (assessment of conditionality compliance and/or disbursement of the next tranche of loans) for a period of time. I use data from [Reinsberg et al. \(2022\)](#) who coded program interruptions between 1978 and 2015. They argue that while interruptions may occur for exogenous or planned reasons (natural disasters, elections) they primarily indicate that the IMF has found the borrower to be non-compliant with a loan condition or mission staff cannot access the necessary information to assess compliance.

The effect of DRS thresholds and IMF programs on hidden debt are robust to these inclusions. Importantly, even when holding these scrutiny indicators constant, the introduction of an IMF program still significantly moderates the effect of DRS thresholds on hidden debt. While the IMF may alter some of its monitoring behavior based on its own administrative burden and borrowers' past behavior, this suggests that the introduction of an IMF program still represents a marked increase in scrutiny that affects borrowers' debt reporting behavior.

Second, I focus on two of these alternate indicators of heightened scrutiny. While I argue that the important shift in IMF monitoring occurs when borrowers are engaged in loan programs, I should still be able to observe the implications of the scrutiny hypothesis when looking at borrowers' history of engagement with the IMF. In Table 10 I interact distance from the threshold with the running count of past IMF programs (model 1) and with the running count of past interrupted IMF programs (model 2). I control for a current IMF program in the current year in both models, and in model 2 I control for the running count of past IMF programs.

Table 9: Controlling for relationship with IMF

	<i>Dependent variable:</i>							
	Hidden proportion of debt to China							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Threshold	−0.037* (0.022)	−0.179*** (0.053)	−0.044** (0.022)	−0.168*** (0.051)	−0.042* (0.023)	−0.177*** (0.053)	−0.040* (0.022)	−0.174*** (0.053)
IMF Program		−0.575*** (0.199)	−0.014 (0.095)	−0.509** (0.207)		−0.547*** (0.202)		−0.540*** (0.204)
Threshold x IMF Program		0.168*** (0.057)		0.147*** (0.055)		0.162*** (0.057)		0.160*** (0.057)
GDP per capita (log)	0.068** (0.034)	0.052 (0.034)	0.077** (0.033)	0.065** (0.033)	0.051 (0.036)	0.041 (0.036)	0.054 (0.036)	0.045 (0.035)
GDP (billion USD, log)	−0.041** (0.020)	−0.041** (0.020)	−0.035* (0.020)	−0.034* (0.019)	−0.033 (0.022)	−0.035 (0.021)	−0.034 (0.021)	−0.036* (0.021)
Debt to China / GDP	0.018*** (0.004)	0.019*** (0.004)	0.019*** (0.004)	0.019*** (0.004)	0.017*** (0.004)	0.019*** (0.004)	0.017*** (0.004)	0.019*** (0.004)
Debt to World Bank / GDP	0.324 (0.357)	0.301 (0.354)	0.355 (0.344)	0.334 (0.341)	0.316 (0.357)	0.295 (0.354)	0.328 (0.357)	0.305 (0.354)
External debt / GDP	−0.001 (0.002)	−0.002 (0.002)	−0.001 (0.002)	−0.001 (0.002)	−0.001 (0.002)	−0.002 (0.002)	−0.001 (0.002)	−0.002 (0.002)
SCI score	−0.0002 (0.002)	−0.001 (0.002)	0.0005 (0.002)	0.0003 (0.002)	−0.0001 (0.002)	−0.0005 (0.002)	−0.001 (0.002)	−0.001 (0.002)
Sub-national taxation	0.262*** (0.046)	0.259*** (0.047)	0.249*** (0.045)	0.248*** (0.045)	0.236*** (0.050)	0.241*** (0.050)	0.247*** (0.047)	0.252*** (0.047)
Debt to IMF / GDP	−0.011 (0.010)	−0.013 (0.010)	−0.006 (0.010)	−0.007 (0.009)	−0.010 (0.010)	−0.012 (0.010)	−0.011 (0.010)	−0.012 (0.010)
Number of global IMF programs	−0.003 (0.004)	−0.003 (0.004)						
IMF Program (lag)			−0.004 (0.087)	−0.010 (0.087)				
Total past IMF loans					−0.008 (0.007)	−0.006 (0.007)		
Total past IMF interruptions							−0.011 (0.008)	−0.007 (0.009)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	350	350	382	382	350	350	350	350

Note:

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

Table 10: Interaction with alternate measures of relationship with IMF

	<i>Dependent variable:</i>	
	Hidden proportion of debt to China	
	(1)	(2)
Threshold	−0.198*** (0.049)	−0.242*** (0.052)
IMF Program	0.022 (0.052)	0.012 (0.057)
Total past IMF loans	−0.077*** (0.018)	−0.005 (0.011)
Total past IMF interruptions		−0.117*** (0.029)
Threshold x Total past IMF loans	0.025*** (0.006)	
Threshold x Total past IMF interruptions		0.042*** (0.010)
GDP per capita (log)	0.060* (0.032)	0.023 (0.036)
GDP (billion USD, log)	−0.020 (0.019)	−0.035* (0.021)
Debt to China / GDP	−0.011** (0.005)	0.017*** (0.004)
Debt to World Bank / GDP	1.081*** (0.327)	0.223 (0.350)
External debt / GDP	−0.004** (0.002)	−0.0003 (0.002)
SCI score	0.005** (0.002)	−0.001 (0.002)
Sub-national taxation	0.295*** (0.046)	0.283*** (0.051)
Debt to IMF / GDP	0.011 (0.009)	−0.016 (0.010)
Above threshold	−0.051 (0.044)	−0.044 (0.049)
Year fixed effects	Yes	Yes
Debt threshold fixed effects	Yes	Yes
Observations	349	349

Note:

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

Both interaction terms are significant and positive, which is consistent with the findings presented in the manuscript using the indicator for IMF programs. As governments engage in repeated loan programs they hide less of their debt to China in response to DSA debt thresholds. This may reflect 2 mechanisms, both of which are consistent with the scrutiny hypothesis. First, repeated IMF involvement may offer governments little opportunity to omit Chinese loans from DRS reports as mission staff regularly review national accounts. Second, IMF staff may see recidivism as an indicator of poor debt management (or manipulation) and increase the intensity of monitoring activities to prevent the need for another loan program in future.

The marginal effects are plotted in Figure G. Given the moderators are now continuous (whereas the IMF program moderator was binary), I generate marginal effects plots using the Interflex package in R ([Hainmueller et al., 2019](#)). This approach computes marginal effects allowing for potentially non-linear functional form and so allows the assessment of significance across the entire range of the moderator. The left panel plots the marginal effect of distance from the threshold across the total count of IMF programs. The Interflex estimate reveals that the interaction is frequently insignificant across the count of past IMF programs, although it shows a broadly positive relationship.

The right panel plots the marginal effect across the count of interrupted IMF programs. Governments that have frequently interrupted past IMF programs engage in less debt manipulation to avoid DSA debt thresholds. This is consistent with the expectation that governments that are subject to the most intense IFI scrutiny will avoid using hidden debt strategically. Governments with little to no record of interruptions may not have triggered alarm bells among IMF staff, and in the absence of additional scrutiny, they continue to hide debt as they approach DSA thresholds. Program interruption has a statistically stronger and substantively larger effect than program count, which is consistent with the expectation that frequent interruptions have an additional effect on future IMF scrutiny beyond the effect of

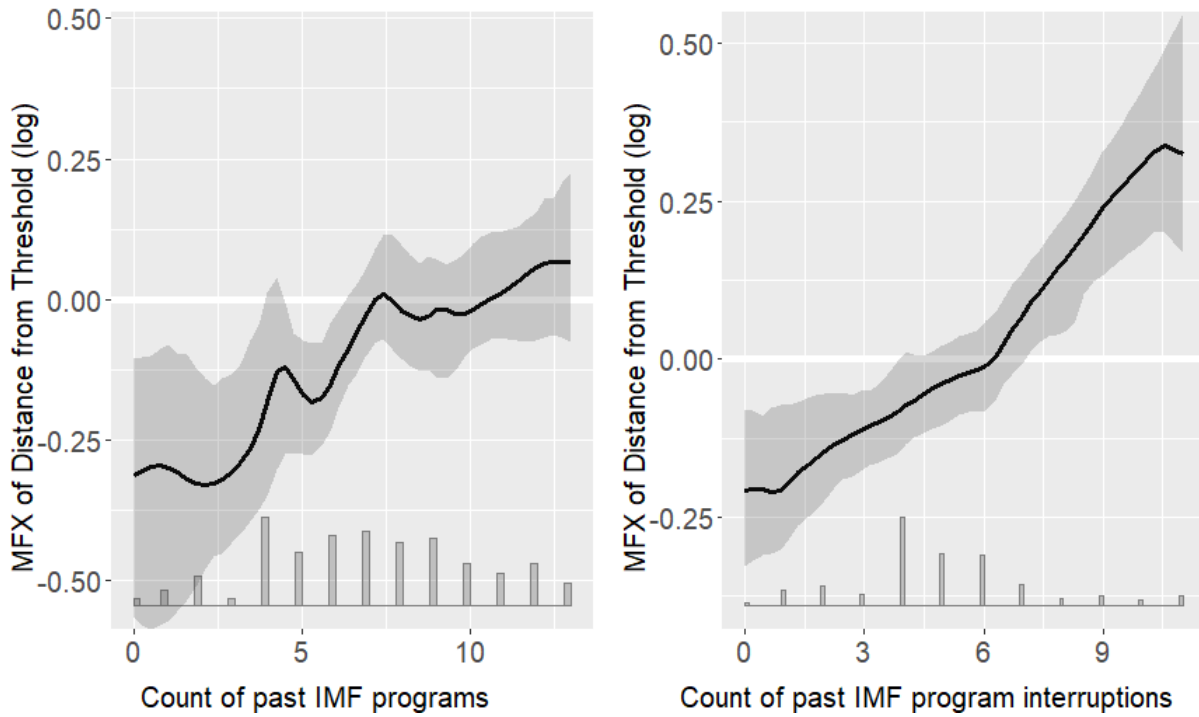


Figure 5: **Marginal effect of Distance to Threshold (log) across IMF program recidivism and interruptions.** This figure plots the marginal effect of distance to the threshold (log) across two indicators of governments' past interactions with the IMF. The left panel plots the marginal effect of *Distance* across a running count of each government's IMF loan programs, and corresponds to model 1 in Table 10. The right panel plots the marginal effect of *Distance* across a running count of each government's IMF loan programs that were temporarily or permanently interrupted, and corresponds to model 2 in Table 10.

frequent loan programs.

H IMF programs and statistical capacity

I argue that the negative conditional effect of IMF loan programs on hidden debt reflects governments' strategic response to the additional scrutiny of Fund staff. However, a drop in hidden debt during a loan program may also reflect IMF bureaucratic and statistical assistance that reduces accidental misreporting. This issue is partially addressed by the inclusion of control variables in the main models and in robustness tests in Appendix F that capture statistical and bureaucratic capacity and governments' past engagement with the IMF. Here, I look for evidence that IMF programs have an effect on government capacity that could support accurate debt reporting, but find no evidence of this effect.

First, I replace the hidden debt dependent variable with two measures of statistical and bureaucratic capacity. Table 11 shows the results using the World Bank Statistical Capacity Index as the dependent variable in columns 1-3, and using the World Bank Country Policy Institutional Assessment score for budgetary management as the dependent variable in columns 4-6. When estimated using OLS (columns 1 and 4), an IMF program is associated with higher capacity. However, this effect disappears when estimated using 2SLS with the compound instrumental variable described in Appendix C (columns 2 and 5). Similarly, the interaction between *IMFProgram* and *Threshold* does not have a significant effect on either dependent variable when estimated using 2SLS (columns 3 and 6).

Table 11: Effect of IMF programs on statistical and bureaucratic capacity

	<i>Dependent variable:</i>					
	SCI			CPIA Budget Management		
	<i>OLS</i>	<i>2SLS</i>	<i>2SLS</i>	<i>OLS</i>	<i>2SLS</i>	<i>2SLS</i>
	(1)	(2)	(3)	(4)	(5)	(6)
IMF Program	3.832*** (1.251)	−8.542 (23.769)	1.257 (16.307)	0.287*** (0.076)	2.224 (2.162)	0.743 (1.008)
Threshold	0.341 (0.493)	−0.204 (1.353)	−0.298 (2.762)	0.040 (0.030)	0.153 (0.121)	0.149 (0.170)
IMF Program:Threshold			0.908 (2.804)			−0.109 (0.173)
IMF probability		14.513 (21.907)	2.605 (7.275)		−1.439 (1.996)	0.273 (0.451)
IMF liquidity ratio (log)		9.525** (3.846)	11.062*** (2.741)		−0.147 (0.347)	−0.368** (0.168)
GDP per capita (log)	−3.255*** (0.730)	−3.339*** (0.974)	−3.083*** (0.832)	−0.177*** (0.045)	−0.100 (0.090)	−0.142*** (0.052)
GDP (billion USD, log)	−0.985** (0.440)	−1.268** (0.539)	−1.110** (0.451)	0.022 (0.027)	0.031 (0.049)	0.006 (0.028)
Debt to China / GDP	−0.269*** (0.081)	−0.265** (0.106)	−0.227*** (0.083)	0.002 (0.005)	0.011 (0.009)	0.006 (0.005)
Debt to World Bank / GDP	5.387 (7.756)	8.023 (8.984)	5.743 (7.822)	−1.093** (0.474)	−1.329* (0.792)	−1.023** (0.480)
External debt / GDP	−0.086* (0.046)	−0.066 (0.073)	−0.096** (0.049)	0.002 (0.003)	−0.003 (0.007)	0.001 (0.003)
Sub-national taxation	−3.153*** (1.018)	−2.289** (1.127)	−2.373** (1.074)	−0.180*** (0.062)	−0.107 (0.101)	−0.092 (0.066)
Debt to IMF / GDP	−1.512*** (0.204)	−1.655*** (0.283)	−1.558*** (0.217)	0.007 (0.012)	0.017 (0.025)	0.003 (0.013)
Above threshold	2.620** (1.015)	0.364 (4.515)	2.812* (1.641)	−0.066 (0.062)	0.291 (0.404)	−0.054 (0.100)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	388	388	388	387	387	387
K-P weak instrument (F-stat): IMFProgram		1.756	9.917		1.674	9.819
K-P weak instrument (F-stat): Threshold x IMFProgram			31.585			31.448

Note:

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

Next, I consider that IMF interventions may have a cumulative effect on governments' ability to accurately report debt. While I expect IMF scrutiny to intensify for the period of a loan program (Hyde and O'Mahony, 2010), the Fund's contribution to statistical and bureaucratic capacity may be the product of repeated rounds of structural benchmark conditions. To test this, I regress the SCI score and CPIA scores on the running count of past IMF programs. Column 1 in Table 12 regresses past IMF programs on the SCI score score, while column 2 uses the CPIA score as the dependent variable. Past IMF programs has an insignificant effect on the SCI score score, suggesting that regular engagement with the IMF is not associated with improved statistical management. Past IMF programs has a significant negative effect on the CPIA score, which is the opposite to expectations if IMF programs contribute to improved debt management and reporting.

Table 12: Effect of past IMF programs on statistical and bureaucratic capacity

	<i>Dependent variable:</i>	
	SCI score	CPIA Budget Management
	(1)	(2)
Total past IMF loans	0.188 (0.156)	-0.054*** (0.009)
Threshold	0.025 (0.517)	-0.011 (0.030)
GDP per capita (log)	-3.088*** (0.819)	-0.300*** (0.048)
GDP (billion USD, log)	-1.108** (0.488)	0.080*** (0.028)
Debt to China / GDP	-0.301*** (0.089)	-0.006 (0.005)
Debt to World Bank / GDP	4.858 (8.065)	-1.263*** (0.468)
External debt / GDP	-0.058 (0.049)	0.004 (0.003)
Sub-national taxation	-3.497*** (1.135)	-0.406*** (0.066)
Debt to IMF / GDP	-1.466*** (0.223)	0.029** (0.013)
Above threshold	1.153 (1.080)	-0.050 (0.063)
Year fixed effects	Yes	Yes
Debt threshold fixed effects	Yes	Yes
Country fixed effects	No	No
Observations	356	355

Note:

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

I Fractional logit estimates

The dependent variable, hidden proportion of debt to China H , is a continuous proportion with bounds from 0 to 1. This data structure can be estimated via a fractional logistic regression that can predict proportions within a bounded range. However, recent literature has cautioned that compared to OLS, fractional logit offers few benefits and raises several problems that come with placing continuous data on a discrete distribution (Kubinec, 2022), most prominently that fractional logit lacks a normalizing constant necessary to obtain true probabilities. Thus, I choose to estimate the main results in the paper using OLS. Further, I use a 2SLS specification to address endogenous IMF program assignment. Given the difficulties of extending an instrumental variables procedure to a non-linear model (Papke and Wooldridge, 2008), I believe it is more intuitive to compare OLS and 2SLS results in the manuscript.

To confirm that the results are not dependent on the specification, I estimate the main models using fractional logit. Table 13 shows the OLS results in columns 1-3 (the same as columns 1-3 in Table 1 of the manuscript) and columns 4-6 replicate the regressions using fractional logit. The coefficients on *Threshold* and the interaction term *ThresholdxIMFProgram* remain significant and in consistent directions across both specifications.

Table 13: Effect of IFI interventions on hidden debt: fractional logit

	<i>Dependent variable:</i>					
	Hidden proportion of debt to China					
	OLS (1)	OLS (2)	OLS (3)	FrL (4)	FrL (5)	FrL (6)
Threshold	-0.042** (0.021)	-0.044** (0.022)	-0.168*** (0.051)	-0.194** (0.096)	-0.204** (0.099)	-0.758*** (0.235)
IMF Program		-0.017 (0.055)	-0.518*** (0.194)		-0.111 (0.251)	-2.343*** (0.895)
Threshold x IMF Program			0.147*** (0.054)			0.655*** (0.251)
GDP per capita (log)	0.078** (0.033)	0.077** (0.033)	0.065** (0.033)	0.340** (0.150)	0.332** (0.151)	0.277* (0.151)
GDP (billion USD, log)	-0.036* (0.019)	-0.035* (0.020)	-0.034* (0.019)	-0.165* (0.090)	-0.162* (0.091)	-0.156* (0.090)
Debt to China / GDP	0.019*** (0.004)	0.019*** (0.004)	0.019*** (0.004)	0.084*** (0.016)	0.083*** (0.017)	0.086*** (0.017)
Debt to World Bank / GDP	0.356 (0.343)	0.355 (0.344)	0.334 (0.341)	1.613 (1.623)	1.615 (1.627)	1.432 (1.618)
Debt to IMF / GDP	-0.007 (0.009)	-0.007 (0.010)	-0.007 (0.009)	-0.036 (0.044)	-0.035 (0.044)	-0.038 (0.044)
External debt / GDP	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)	-0.006 (0.009)	-0.006 (0.010)	-0.006 (0.009)
SCI score	0.0003 (0.002)	0.0004 (0.002)	0.0002 (0.002)	0.001 (0.011)	0.002 (0.011)	0.001 (0.011)
Sub-national taxation	0.253*** (0.044)	0.249*** (0.045)	0.249*** (0.045)	1.132*** (0.202)	1.110*** (0.208)	1.115*** (0.208)
Above threshold	-0.051 (0.043)	-0.055 (0.045)	-0.044 (0.044)	-0.240 (0.200)	-0.263 (0.207)	-0.215 (0.208)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	382	382	382	382	382	382

Note:

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

J Country fixed effects

Table 14 shows the results from the main models including both country and year fixed effects. Columns 1 and 2 show the effect of distance from the threshold. Column 3 shows the interaction between *Threshold* and *IMFprogram* estimated via OLS, while Column 4 shows in the interaction effect estimated with 2SLS.

The Kleinbergen-Paap F statistics shown in the bottom panel are smaller than those for the year FE estimates and are below conventional levels for weak identification ($F = 10$). The F statistics are only narrowly above the minimum critical value of 5.53 suggested by (Stock and Yogo, 2002).

Table 14: Effect of IFI interventions on hidden debt to China: alternate fixed effects

	<i>Dependent variable: Hidden proportion of debt to China</i>			
	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>2SLS</i>
	(1)	(2)	(3)	(4)
Threshold	−0.033 (0.024)	−0.040* (0.024)	−0.085 (0.066)	−0.137 (0.111)
IMF Program		−0.316*** (0.074)	−0.460** (0.207)	−0.873 (0.639)
Threshold x IMF Program			0.047 (0.063)	0.093 (0.110)
GDP per capita (log)	−0.413 (0.394)	−0.201 (0.387)	−0.142 (0.395)	−0.115 (0.929)
GDP (billion USD, log)	0.165 (0.371)	0.081 (0.362)	0.007 (0.376)	0.039 (0.702)
Debt to China / GDP	0.019*** (0.005)	0.018*** (0.004)	0.018*** (0.004)	0.018*** (0.005)
Debt to World Bank / GDP	0.273 (0.389)	0.205 (0.380)	0.223 (0.381)	0.112 (0.398)
External debt / GDP	−0.002 (0.002)	−0.002 (0.002)	−0.002 (0.002)	−0.001 (0.002)
SCI score	0.001 (0.003)	−0.0001 (0.003)	0.00003 (0.003)	−0.001 (0.003)
Sub-national taxation	−0.238 (0.254)	−0.278 (0.247)	−0.200 (0.269)	−0.337 (0.510)
Debt to IMF / GDP	−0.004 (0.015)	0.006 (0.014)	0.004 (0.014)	0.013 (0.017)
Above threshold	−0.005 (0.055)	−0.023 (0.054)	−0.029 (0.055)	−0.054 (0.061)
IMF probability				−0.302 (0.698)
IMF liquidity ratio (log)				0.283 (0.209)
Year fixed effects	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
IV	No	No	No	Yes
Observations	382	382	382	382
K-P weak instrument: IMF Program				
F-stat				6.882
P-value				0.000
K-P weak instrument Threshold x IMFProgram:				
F-stat				10.881
P-value				0.000

Note:

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

K Over-fitting checks

With the inclusion of many control variables, over-fitting becomes a concern and may artificially inflate the coefficients on the main independent variables of interest (Vadlamannati and Brazys, 2022). To guard against this, I first estimate models including only statistically significant controls in Table 15 (but still including the constituent terms of interactions to ensure the model is correctly specified). I next estimate the main *Threshold* model dropping control variables one at a time in Table 16. The coefficients on *Threshold* and *Threshold* x *IMFProgram* are robust to these adjustments.

Table 15: Effect of IFI interventions on hidden debt to China: dropping insignificant controls

	<i>Dependent variable: Hidden proportion of debt to China</i>			
	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>2SLS</i>
	(1)	(2)	(3)	(4)
Threshold	−0.048*** (0.017)	−0.048*** (0.017)	−0.176*** (0.048)	−0.303** (0.120)
IMF program		−0.010 (0.050)	−0.520*** (0.188)	−1.489** (0.713)
Threshold x IMF program			0.148*** (0.052)	0.279** (0.127)
GDP per capita (log)	0.060** (0.025)	0.059** (0.026)	0.049* (0.026)	0.042 (0.030)
GDP (billion USD, log)	−0.025* (0.014)	−0.025* (0.014)	−0.022 (0.013)	−0.037** (0.017)
Debt to China / GDP	0.018*** (0.003)	0.018*** (0.003)	0.019*** (0.003)	0.019*** (0.003)
Sub-national taxation	0.252*** (0.039)	0.250*** (0.041)	0.249*** (0.040)	0.267*** (0.047)
Above threshold				−0.094 (0.057)
IMF probability				0.497 (0.305)
IMF liquidity ratio (log)				−0.082 (0.142)
Year fixed effects	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes
IV	No	No	No	Yes
Observations	382	382	382	382
K-P weak instrument: IMF Program				
F-stat				13.938
P-value				0.000
K-P weak instrument Threshold x IMFProgram:				
F-stat				41.317
P-value				0.000

Note:

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

Table 16: Effect of IFI interventions on hidden debt to China: dropping insignificant controls

	<i>Dependent variable:</i>								
	Hidden proportion of debt to China								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Threshold	-0.047** (0.021)	-0.047** (0.020)	-0.051** (0.021)	-0.049** (0.021)	-0.048** (0.019)	-0.045** (0.021)	-0.053** (0.022)	-0.042** (0.020)	-0.050** (0.021)
IMF Program	-0.004 (0.052)	-0.023 (0.052)	-0.056 (0.054)	-0.019 (0.054)	-0.018 (0.053)	-0.018 (0.055)	-0.068 (0.055)	-0.014 (0.054)	-0.022 (0.054)
GDP per capita (log)	0.012 (0.034)	0.024 (0.030)	-0.032 (0.030)	0.017 (0.033)	0.017 (0.034)	0.066** (0.031)	-0.012 (0.035)	0.036 (0.030)	
GDP (billion USD, log)	0.031 (0.028)	0.026 (0.026)	0.083*** (0.023)	0.032 (0.028)	0.031 (0.026)	-0.037* (0.019)	0.051* (0.029)		0.039 (0.025)
Debt to China / GDP	0.018*** (0.003)	0.019*** (0.003)	0.016*** (0.003)	0.018*** (0.003)	0.018*** (0.003)	0.018*** (0.004)		0.018*** (0.003)	0.018*** (0.003)
Debt to World Bank / GDP	0.00001*** (0.00000)	0.00001*** (0.00000)	0.00002*** (0.00000)	0.00001*** (0.00000)	0.00001*** (0.00000)		0.00001*** (0.00000)	0.00001*** (0.00000)	0.00001*** (0.00000)
External debt / GDP	-0.001 (0.001)	-0.00003 (0.001)	0.0004 (0.001)	0.0001 (0.001)		0.0001 (0.002)	0.001 (0.002)	-0.001 (0.001)	0.0002 (0.001)
SCI score	-0.0002 (0.002)	0.001 (0.002)	-0.001 (0.002)		0.0002 (0.002)	0.001 (0.002)	-0.002 (0.002)	0.0001 (0.002)	-0.0001 (0.002)
Sub-national taxation	0.160*** (0.052)	0.178*** (0.050)		0.163*** (0.052)	0.164*** (0.052)	0.259*** (0.044)	0.109** (0.053)	0.197*** (0.043)	0.151*** (0.046)
IMF debt / GDP	-0.007 (0.009)		-0.005 (0.009)	-0.006 (0.009)	-0.006 (0.009)	-0.007 (0.009)	-0.011 (0.010)	-0.008 (0.009)	-0.007 (0.009)
Above threshold		-0.025 (0.041)	-0.042 (0.044)	-0.049 (0.044)	-0.048 (0.038)	-0.058 (0.045)	-0.033 (0.045)	-0.049 (0.044)	-0.046 (0.043)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Debt threshold fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	382	414	382	382	382	382	382	382	382

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

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