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BP/16/05

On the Effect of IMF Data Standards Initiatives: Do They Affect Foreign Direct Investment, Exchange Rate Volatility, and Sovereign Borrowing Costs?

Carlos de Resende and Franz Loyola

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February 25, 2016

JEL Classification Numbers: F2, F3, F4

Keywords: data initiatives, capital flows, sovereign borrowing spreads and yields, exchange rate volatility

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* The authors acknowledge the helpful comments and suggestions from colleagues at the IEO—Miguel de Las Casas, Francesco Luna, Ruben Lamdany, Thomas Reichmann, Louellen Stedman, and Nancy Wagner—as well as from Camelia Minoiu and Sam Ouliaris, who kindly agreed to review the econometric work done in this paper. Any remaining errors are the sole responsibility of the authors.

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ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AE	Advanced economies
AR	Auto-regressive
CBOE	Chicago Board Options Exchange
CGG	Cady and Gonzalez-Garcia
CP	Cady and Pellechio
EME	Emerging market economies
FDI	Foreign direct investment
FFR	Federal Funds Rate
GDDS	General Data Dissemination System
GDP	Gross national product
GMM	General Method of Moments
HP	Hodrick-Prescott filter
HW	Hashimoto and Wacker
ICRG	International Country Risk Guide
IEO	Independent Evaluation Office
IFS	*International Financial Statistics*
IIF	Institute of International Finance
IMF	International Monetary Fund
IPS	Im, Pesaran, and Shin
LIC	Low-income countries
LLC	Levin, Lin, and Chu
LYS	Levy-Yeyati and Sturzenegger
NFA	Net foreign assets
OLS	Ordinary least squares
PPP	Purchasing power parity
RA	Reserve adequacy
RT	Reserves Template
SDDS	Special Data Dissemination Standard
TED	T-Bill and Eurodollar
VIX	Market volatility index published by the CBOE
WB	World Bank
WDI	World Development Indicators
WEO	*World Economic Outlook*

EXECUTIVE SUMMARY

The IMF's data dissemination initiatives—in particular, the Special Data Dissemination Standard (SDDS) and the General Data Dissemination System (GDDS)—are designed to help participating countries improve their data dissemination practices and, in the process, are expected to increase transparency about the macroeconomic and financial situation of these countries, reducing noise-to-signal ratios for investors and improving the functioning of markets.

IMF research suggests that this channel, when a country participates in these initiatives, can have significant beneficial effects on selected international finance variables, including foreign direct investment inflows (FDI), exchange rate volatility, and sovereign bond spreads or yields. For example:

- Hashimoto and Wacker (2012) found that subscription to the SDDS increased (gross) FDI inflows by about 60 percent;

- Cady and Gonzales-Garcia (2007) found that exchange rate volatility decreased by 20 percent in 48 countries upon the adoption of the SDDS "reserves template" for the dissemination of data on foreign liquidity positions; and

- Cady and Pellechio (2006) report that subscription to the SDDS and GDDS helped to reduce launch spreads on the sovereign bonds of 26 emerging market economies, by an average of 20 percent and 8 percent, respectively.

This paper evaluates the robustness of these findings, relying on both the same raw dataset originally used by IMF researchers and an updated dataset that incorporates revisions, additional countries, and more recent periods. The data, adjusted for potential problems that have been previously overlooked (e.g., non-seasonally adjusted quarterly data, nonstationarity, and different types of measurement errors), were subjected to both the same econometric models originally used by the IMF researchers and to models with different specifications. The alternative specifications control for additional factors such as time dependency, global, and domestic factors that were not always controlled for in the earlier research.

Our results indicate that the IMF research findings regarding the effects of the data standards are not robust. These findings were often based on problematic transformations of the data whose removal or correction substantially changes the original conclusions. They are also not robust to changes in the sample. In some instances, they reflect insufficient consideration of the effect of factors other than IMF data initiatives—such as global developments that may affect all countries, or time dependency. One conclusion—that SDDS helps to reduce exchange rate volatility—seems to be the result of a misinterpretation of the original results. All these problems occur separately or in combination. Event studies confirm the lack of robustness of the IMF research findings on the effects of the data standards.

Moreover, the paper does not find convincing evidence that subscribing to IMF data standards have a strong and clear effect on (the lack of) transparency in terms of availability of information. This finding casts doubt on the main channel through which these data initiatives supposedly work, and it complements the results of the robustness checks.

Our findings do not, however, imply that IMF data standards initiatives are not effective in other dimensions, which are documented in “Behind the Scenes with Data at the IMF: An IEO Evaluation” by the Independent Evaluation Office (IEO, 2016).

I. Introduction

1. IMF research suggests that a country's subscription to IMF data standards initiatives—more specifically, the Special Data Dissemination Standard (SDDS) and the General Data Dissemination System (GDDS)—can have significant beneficial effects on selected international finance variables by increasing transparency about a country's economic situation and reducing noise-to-signal ratios for investors.[1]

2. For example, Hashimoto and Wacker (2012) find that subscription to the SDDS increases a country's (gross) foreign direct investment (FDI) inflows by about 60 percent. In addition, Cady and Gonzales-Garcia (2007) document a 20 percent decrease in exchange rate volatility in 48 advanced, emerging-market, and low-income countries upon the adoption of the SDDS "reserves template" (RT) for the dissemination of data on foreign liquidity positions. Cady and Pellechio (2006) report that subscription to the SDDS and GDDS helped to reduce launch spreads on the sovereign bonds of 26 emerging market economies by an average of 20 percent and 8 percent, respectively.

3. As part of the evaluation "Behind the Scenes with Data at the IMF: An IEO Evaluation," conducted by the Independent Evaluation Office (IEO, 2016), this paper assesses the robustness of the IMF research findings on the effects of SDDS and GDDS subscription. If confirmed, these findings have important policy implications for both the IMF and its membership.

4. First, they would corroborate the IMF's efforts on such initiatives, with implications for the allocation of its limited resources to provide and manage such data standards initiatives, within its Statistics Department (STA). Since other programs in STA—such as Reports on the Observance of Standards and Codes (ROSCs), which are highly appreciated by the IMF membership (de Las Casas and Monasterski, 2016)—compete for the same pool of resources, understanding the benefits of SDDS and GDDS to the membership is important to evaluate whether STA resources are being efficiently allocated.

5. Second, the favorable IMF research findings on the effects of data dissemination initiatives provide a strong incentive for member countries, especially emerging-market and low-income economies, to invest in their data and statistics capabilities in order to qualify for and join IMF data standards initiatives.[2]

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[1] For an overview of the IMF's data standards initiatives, see http://dsbb.imf.org/Pages/SDDS/Overview.aspx and http://dsbb.imf.org/Pages/GDDS/WhatIsGDDS.aspx. For IMF research related to these initiatives, see http://dsbb.imf.org/Pages/SDDS/Home.aspx.

[2] Subscription to both the SDDS and GDDS is voluntary. For the SDDS, it requires a commitment to observe the standard—on factors related to data coverage, periodicity, and timeliness; access by the public; and integrity and quality of the disseminated data. The GDDS requires its participants to use its framework for statistical development and for planning short- and longer-term improvements in disseminating economic and financial

6. The rest of the paper is organized as follows. Section II investigates the presumed main channel of transmission of the impact of IMF data standards initiatives on international finance variables. The focus is on measuring the effect of these initiatives on indicators of transparency or availability of information. Sections III–V cover the effects of the data standards initiatives on (i) FDI gross inflows, (ii) exchange rate volatility, and (iii) sovereign borrowing costs (yields and spreads). Section VI uses "event studies" as an alternative approach to identify the effect of participation in IMF data standards on the above variables. Section VII concludes.

7. Each of these sections checks the robustness of results reported in the three IMF publications mentioned above—which are available on the IMF's website and could be used to support the notion that "SDDS should contribute to the improved functioning of financial markets." In each section, we first run robustness checks using the original dataset that was available to the authors when the papers were published—to verify the soundness of the methodology (based on the estimation of cross-country panel regressions) and the adequacy of the data used.[3] The robustness checks apply the same econometric models as used by the original authors to both the original dataset and to an updated sample that incorporates additional countries and more recent periods. We also provide new econometric evidence of the potential effects of SDDS and GDDS on the three variables of interest, based on alternative specifications of the original estimated equations, in which we use different estimation techniques and/or a different set of control variables.

8. Our results indicate that the IMF research findings about the effects of its data dissemination standards initiatives are: (i) likely erroneous for FDI flows, (ii) overstated for exchange rate volatility, and (iii) dubious for sovereign borrowing costs. The original IMF findings are often based on transformations of the data whose removal or correction substantially changes the original results. Overall, the original findings are not robust to changes in the sample. In some instances, they reflect insufficient consideration of the effect of factors other than the IMF data standards initiatives that are not properly controlled for in the estimations—such as global factors, which can potentially affect all countries, and time dependency. One conclusion—that SDDS helps reduce exchange rate volatility—seems to be the result of a misinterpretation of the estimated coefficients. All these problems occur separately or in combination.

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data. Subscribers to each must provide certain information (metadata) to the IMF about their data dissemination practices. At present, there are 64 subscriptions to the SDDS and 112 to GDDS.

[3] We thank the authors of these studies, who graciously made all the programs and data used in their analyses available to us.

9. Our findings—which hinge on the assessment of the IMF data standards initiatives narrowly based on their effects on selected macro-financial variables—should not be taken to imply that these IMF data standards initiatives are not effective in other dimensions.[4]

II. IMF Data Standards Initiatives and Transparency

10. The main channel of transmission of the effect of SDDS and GDDS to capital flows, volatility of exchange rates, and sovereign borrowing costs—as suggested in the IMF research papers analyzed here—is through increased transparency, which in turn should reduce noise-to-signal ratios and facilitate decisions for investors.

11. Table 1 shows the results of a panel regression of a measure of opacity (lack of availability of information) discussed in Brandão-Marques, Gelos, and Melga (2013) and a dummy variable for participation in IMF data standards initiatives.[5] Country and period fixed effects are included to account for other domestic and common factors affecting opacity. The sample covers 30 countries from 1997 to 2012, of which 25 are either emerging-market economies (EMEs) or low-income economies (LICs).

12. A negative and statistically significant estimated coefficient associated with the IMF data initiatives dummy indicates that such initiatives reduce opacity and provides evidence that this channel is plausible. The results, however, do not support this conclusion: the estimated coefficient is never statistically significant at standard levels and, in one case, it is even positive.

Table 1. Relationship Between Participation in IMF Data Initiatives and Opacity

	Full Sample		EMEs and LICs	
	SDDS	GDDS	SDDS	GDDS
Estimate Coefficient	-0.87	-8.00	0.41	-9.35
p-value	(0.77)	(0.18)	(0.90)	(0.11)
Cross-sections	30	30	25	25
Obs	416	416	341	341
Adj. R^2	0.86	0.87	0.83	0.84

Source: Authors' calculations using data from Brandão-Marques, Gelos, and Melga (2013).

[4] Survey-based evidence presented in de Las Casas and Monasterski (2016), and also discussed in IEO (2016), suggests that the SDDS and GDDS may have played an important role in advancing data dissemination worldwide, improving both data quality and third parties' perception of national data across countries. Moreover, subscription to the SDDS is one of the twenty criteria used by the Institute of International Finance (IIF)—a global association of the financial industry, which advocates for policies that are in the broad interests of its close-to 500 members from 70 countries—to construct indices for the evaluation of investor relations and data dissemination practices across emerging-market sovereign-debt-issuing countries. See IIF (2015). This opens the possibility that a country's SDDS subscription status may be, at least partially, relevant for international investors' decisions in a way that our study did not capture.

[5] In the case of SDDS, the dummy takes the value of one if country *i* met SDDS specifications by year *t*. In the case of GDDS, it equals one if country *i* is a subscriber of GDDS by year *t*. The reason for the difference in treatment is the very limited availability of data on opacity indicators prior to SDDS subscription for most countries. Using the dates when countries actually met the SDDS specification mitigates the problem.

III. The SDDS and Capital Inflows

13. This section investigates the effect of meeting the requirements for SDDS subscription on gross foreign direct investment (FDI). We first examine the estimations by Hashimoto and Wacker (2012)—henceforth HW—and then propose an alternative specification.

A. Hashimoto and Wacker (2012)

14. Hashimoto and Wacker (2012) suggest that subscription to SDDS increased foreign direct investment by about 60 percent among SDDS subscribers. They estimate the following fixed-effects panel regression, using annual data from 70 SDDS subscribers over the period 1970–2010:

$$log\, y_{it} = \beta + \alpha_i + \eta_t + \lambda SDDS_{it} + \theta\Psi_{it} + \varepsilon_{it}, \quad (1)$$

where y_{it} is a measure of capital inflows (FDI or portfolio) in country i, in year t; β is a constant; α_i and η_t are country specific and year fixed effects, respectively; $SDDS_{it}$ is a dummy variable that takes the value of one if country i met the SDDS specifications by year t; Ψ_{it} is a vector of control variables that includes macroeconomic variables, measures of institutional quality, and indicators of productivity;[6] and ε_{it} is an error term.

15. HW's strategy is to exploit the variation *within* countries over time to capture meaningful differences in capital flows before and after SDDS subscription, relying on the year fixed effects, η_t, to control for global factors common to all countries, and on country fixed effects, α_i, and vector Ψ_{it}, to control for domestic factors.

16. The parameter of interest is λ.[7] Regarding FDI inflows, the HW estimates of λ are 0.4462 or 0.4760, depending on the set of control variables used. These estimates imply increases of 56.2 percent and 60.9 percent in FDI, respectively, after countries meet the SSDS requirements. In the case of portfolio inflows, the estimated λ is found not to be statistically significant. In our analysis, we will focus on FDI flows.

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[6] The vector of control variables is fully described in HW (2012), Appendix B: 35–36.

[7] The percentage increase in capital inflows when $SDDS$ switches from 0 to 1 is equal to $(e^{\lambda} - 1) \times 100$.

B. Data Issues

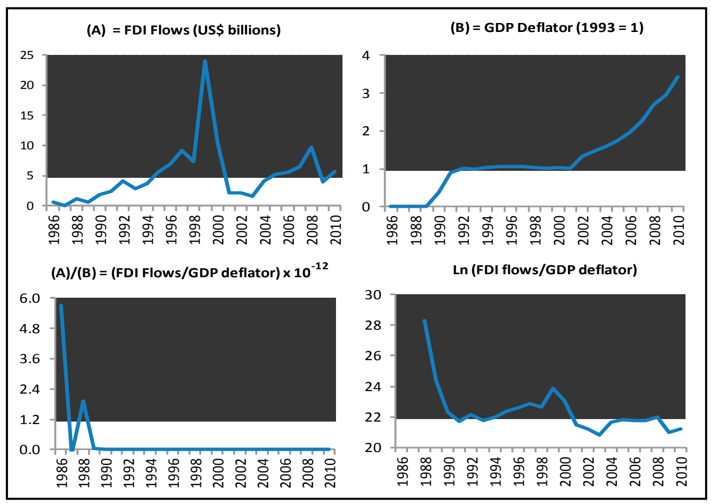
17. We have two interrelated concerns regarding the data used in HW (2012): transformations in the variable of interest (FDI) and nonstationarity issues. The latter impose a common difficulty of working with gross rather than net flows.[8]

Concerns about the measure of capital inflows

18. The variable used by HW as the dependent variable y_{it}, in equation (1) is the gross FDI inflow—measured in U.S. dollars—deflated by the *domestic* GDP deflator, which mainly reflects prices in the local currency. This measure seems problematic in a panel setup for two main reasons.

19. First, the "within" variation in the data (i.e., within a country, across time)—crucial for the before-after SDDS comparisons—is highly affected by domestic inflation rates, sometimes dramatically. Consider the example of FDI flows to Argentina over the sample period used in HW (2012), displayed in Figure 1. FDI measured in U.S. dollars (upper left panel) is transformed when normalized by the GDP deflator (upper right) to produce the deflated measure of FDI flows (lower left). A marked downward trend is introduced simply because of the hyperinflation that Argentina experienced in the first years of the sample, when actual capital inflows were on the rise. This effect remains, although mitigated, after rescaling using a log-transformation (lower right panel).[9] This implies that the "within" variation of (transformed) FDI inflows can be very misleading when comparing pre- and post-SDDS subsamples.

Figure 1. Argentina: FDI Flows and GDP Deflator



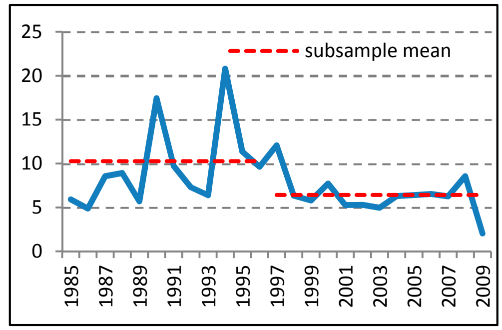
Source: Authors' calculations using data from HW (2012).

[8] Gross flows are, however, more appropriate for the study of SDDS subscription on capital inflows because it is more closely related to the behavior of foreign investors, towards whom the signaling of enhanced transparency supposedly works. Using net flows makes the identification of determinants of capital flows more difficult, because actions by foreign and domestic investors can counteract each other. See Forbes and Warnock (2012).

[9] High inflation rates plague a significant share of the countries in the sample: one in five countries show *average* annual GDP inflation rates above 10 percent, while 21 percent of the observations refer to annual inflation rates above that threshold.

20. HW's transformation on FDI also makes the "between" variation (i.e., across countries in a given year) hard to interpret. Since the dependent variable's unit of measurement differs across countries, the cross-country averages are not well defined for any given year.[10] Moreover, the "between" variation in the data is also affected by cross-country differences in inflation rates—which will affect the (transformed) series of capital inflows in different ways across countries.[11] This is a problem because it distorts the estimated year fixed effects, which will pick up global factors affecting not only capital inflows but also inflation rates across countries—for example, the common effects of disinflationary processes that tended to be concentrated in the later portion of the sample period (Figure 2).[12]

Figure 2. Average GDP Inflation Rate



Source: Authors' calculations using data from HW (2012).

Nonstationarity

21. In contrast to the case of *net* capital flows, nonstationarity in *gross* capital flows data is likely to be pervasive.[13] Figure 3 shows the evolution of the transformed measure of FDI inflows used as a dependent variable in equation (1), together with a regression line, in all 70 countries in the sample. An informal inspection of fitted regression lines indicates upward trends in 45 countries.[14] Since the vector of control variables Ψ_{it}, also includes trending or nonstationary variables—such as the *level* of GDP (in logs)—a misspecified regression cannot be ruled out. In this case, an omitted deterministic or stochastic time trend is correlated with both the dependent variable and the regressors, invalidating standard statistical inference tests.[15]

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[10]An additional complicating factor is that the series of GDP deflators used by HW in the normalization of FDI flows do not have the same base year in all countries. For instance, for the United States, the GDP deflator series is based (i.e., takes the value of one) in 2005, while for Argentina it is based in 1993.

[11] The country-specific averages of the annual GDP inflation rates in the HW sample have a mean of 7.5 percent and a standard deviation of 7.7 percent, ranging from negative 1.6 percent (Hong Kong) to 35.4 percent (Turkey).

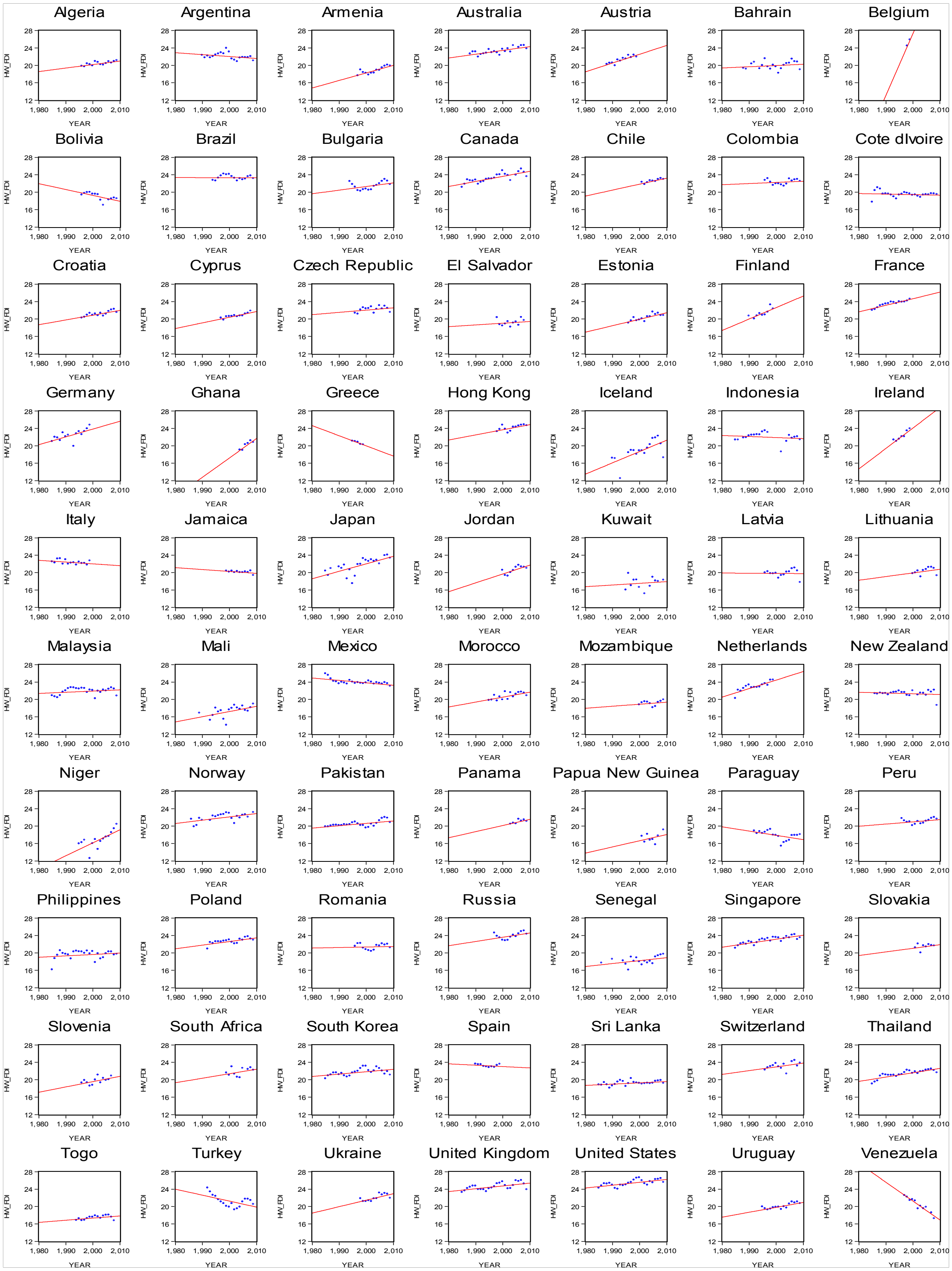
[12] In the effective sample in HW's estimation of equation (1) for FDI, the average GDP inflation rates are higher in 1988–96 relative to 1997–2009 in 46 of the 53 countries for which the comparison is possible. The average and maximal differences between the subsamples are 5.4 percentage points and 58 percentage points (Bolivia), respectively.

[13] Despite a growing literature on the determinants of capital flows that focuses on gross flows data (Forbes and Warnock, 2010), nonstationarity in gross flows is often invoked to motivate studies based on net capital flows data. See *WEO* (IMF, 2011): 126.

[14] Figure 3 also shows *downward* trends in nine countries, most of which have experienced very high inflation rates over the sample period—some even hyperinflation—such as Argentina, Bolivia, Turkey, and Mexico.

[15] See Hamilton (1994), pp. 557–62.

Figure 3. HW's Measure of FDI Inflows



Source: Authors' calculations using data from HW (2012).

22. Table 2 shows the results from panel and country-by-country unit root tests on FDI inflows—both in U.S. dollars and transformed as in HW's study—and the (log) GDP level, using HW's original dataset. There is strong evidence of nonstationarity in these series. Considering five different types of panel unit root tests, the null hypothesis of a unit root cannot typically be rejected at usual significance levels (marked in red) in either FDI flows or GDP. Evidence of nonstationarity in panel data also exists for the transformed measure of FDI, although less strongly (the null hypothesis of a panel unit root only cannot be rejected in Breitung's test). Consistently, when considering country-specific unit root tests, the null hypothesis of a unit root can be rejected in fewer than 35 percent of countries in the sample (at most 24 out of 70 countries).[16]

Table 2. Unit Root Tests (HW's sample: 70 countries)

	FDI flows		log(FDI flows/GDP deflator)		log(GDP)	
	No Trend	Trend	No Trend	Trend	No Trend	Trend
Panel 2 (*p* -values for the null hypothesis of a unit root)						
LLC	1.00	0.68	0.00	0.00	0.01	0.00
BTG	n.a	0.99	n.a	0.79	n.a	1.00
IPS	1.00	0.31	0.00	0.01	0.99	0.99
ADF	0.77	0.00	0.00	0.00	0.74	0.96
PP	0.00	0.00	0.00	0.00	0.00	0.14
Country-by-country PP tests (number of countries for which unit root is rejected)						
at 5%	10	15	16	14	9	7
at 10%	16	19	18	24	9	8

Source: Authors' calculations.
Note: LLC = Levin, Lin, and Chu (2002); BTG = Breitung (2000); IPS = Im, Pesaran and Shin (2003), ADF = Augmented Dickey-Fuller test and PP = Phillips-Perron tests. See Maddala and Wu (1999) and Choi (2001). Hadri's test is based on the Heteroscedastic-consistent *z*-stat. Lags selected automatically based on the Modified Schwarz information criterion.

23. HW (2012) did not consider these issues. In the next two subsections, we assess the sensitivity of their conclusions to the use of alternative measures of the dependent variable that mitigate these concerns.

C. Robustness Checks

24. This subsection investigate the extent to which HW's main result—that meeting SDDS standards leads to an increase of about 60 percent in FDI inflows—is driven by a failure to properly capture (i) global factors that primarily affect FDI flows but not inflation (given the potential distortion in estimated year fixed effects) and/or (ii) stochastic or

[16] Karlsson and Löthgren (2000) argue that if tests have high power, a rejection of the panel unit root null can be driven by a few stationary country-specific series that make the whole panel erroneously be taken as stationary.

deterministic trends in FDI inflows, which typically increased worldwide after the mid-1990s.

Robustness to deterministic trends and autoregressive terms

25. How do the HW results change when different approaches are used to account for time dependency in FDI inflows and for factors common to all countries in the sample?

26. Table 3 displays the estimated SDDS effect on FDI inflows from alternative specifications of equation (1) using HW's original dataset. For convenience, the result from HW's specification is reported in the first row. The results are robust to including common deterministic time trends or common first-order lags of the dependent variable—either independently or combined—instead of year fixed effects (rows 2–4): the estimated SDDS effects are somewhat reduced but remain statistically and economically significant. The results are also robust to using global FDI (as a share of global GDP) as a way to capture global trends in FDI[17]—either combined with time fixed effects, a common trend, and a common AR(1) term assuming a common effect across all countries (rows 5–7), or by itself allowing for country-specific coefficients (row 8).

Table 3. Sensitivity of HW's Results to Time Trends and Global Factors

Alternative Specifications of HW Equation	Estimated Coefficient (λ)	*p*-value	Implied SDDS Effect [(1)]	*p*-value[(2)]
1 Time Fixed Effects, as in HW(2012)	0.44	0.00	57.1%	0.00
2 Common linear trend	0.32	0.00	50.6%	0.00
3 Common AR(1) term	0.31	0.00	50.3%	0.00
4 Common AR(1) term + common trend	0.29	0.00	49.1%	0.01
5 world FDI as share of GDP + time FE	0.47	0.00	58.8%	0.00
6 world FDI as share of GDP + trend	0.31	0.00	50.3%	0.00
7 world FDI as share of GDP + AR(1)	0.26	0.00	47.9%	0.01
8 world FDI as share of GDP, indiv. coef.	0.24	0.00	46.9%	0.01
9 Individual linear trends	0.04	0.70	38.4%	0.71
10 Individual AR(1) term	0.10	0.20	40.7%	0.22
11 Individual trend + common AR(1)	0.04	0.72	38.1%	0.73
12 Individual AR(1) + common trend	0.07	0.40	39.6%	0.42
13 world FDI as share of GDP, indiv. coef. + trend	0.16	0.10	43.2%	0.13
14 world FDI as share of GDP, indiv. coef. + AR(1)	0.13	0.09	41.9%	0.11
15 Individual trend + common AR(1) + world FDI shr	0.03	0.76	37.9%	0.77
16 Individual AR(1) + common trend + world FDI shr	0.09	0.29	40.3%	0.31

Source: Authors' calculations using data from HW (2012).
Notes: (1) Equal to $(e^{\lambda} - 1)$, in percent; (2) Computed using the delta method.

[17] When computing "global" aggregates for FDI and GDP used in each cross-section, the values for the associated country-year are excluded to minimize reverse causality concerns.

27. However, using country-specific trends or AR (1) terms instead of year fixed-effects (rows 9–12), or allowing for the effect of the global FDI-to-GDP ratio to be country-specific in combination with a (common) trend or AR (1) term (rows 13–16) drastically reduce the SDDS coefficient, which tends to become statistically insignificant. Consistent with the country-by-country unit-root tests in Table 2, these results suggest that country-specific trends have not been appropriately accounted for in HW's estimations, with important implications for the estimated effects of SDDS.

"Placebo" estimations

28. An alternative way to assess whether a failure to account for trends and nonstationarity in the data produced misspecified regressions in HW (2012) is to estimate "placebo" regressions. In these, the true dates of SDDS subscription used to create the SDDS dummy, are intentionally changed—backwards and forwards, deterministically or randomly. Strong results for the effect of SDDS on FDI even with the *false* SDDS dates would constitute evidence of misspecified regression, where the SDDS dummy variable most likely simply captures the before-after effect of growth in FDI over time, not the effect of the SDDS initiative per se.

29. Results of two types of placebo tests on the estimation of equation (1) for FDI are displayed in Table 4. The first three columns refer to estimations using the same dataset and model as HW (2012) but counterfactually moving the SDDS date up to ten years before and five years after the actual date of subscription (t_0). When the SDDS date is moved forward (i.e., to t_0+n years), except for one-year-ahead changes, the estimated coefficient is drastically reduced relative to the original estimate and is no longer statistically significant. This tends to validate HW's results. But using backward changes and one-year-ahead changes in the SDDS date yields estimates of the SDDS effect that are very similar in magnitude to that in HW (2012) and are statistically significant, indicating that actual SDDS dates do not seem to be particularly important for the results.[18]

30. In the remaining (right) portion of Table 4, the changes in the SDDS dates are random. First, 100 estimations with the redefined SDDS dummy variables are conducted for three different time intervals both with and without the actual date in the randomization exercise. Note that for the longer interval—SDDS dates allowed to randomly change between ten years before t_0 and five years after t_0—about half of the estimated SDDS coefficients are statistically significant at the 5 percent level (two-thirds are significant at the 10 percent level), while the average estimated coefficient (0.26–0.27) implies an increase of about 30 percent in FDI inflows. When the interval for the randomization of SDDS dates is

[18] A caveat applies here. Given the typically upward trend in FDI, moving the SDDS dates backward reduces the average FDI inflows for the pre-SDDS period *proportionally* by more than the reduction in the post-SDDS average, biasing the estimates of the marginal effect of the SDDS *upward*. This may partially explain why the SDDS effect seems to increase when the SDDS dates are moved eight years or more backwards. The opposite applies when SDDS dates are moved forward, which may account for the low and statistically non-significant SDDS effect estimates when SDSS dates are moved two years or more into the future.

shortened to two years before and after t_0, the estimated SDDS effects are stronger even if the actual dates are excluded from the exercise. Finally, when SDDS dates are allowed to randomly change, either in fixed five-year intervals between t_0-10 and t_0+5—minimizing, therefore, the effect of "centering" the intervals around t_0—or in a fixed five-year interval that does not include t_0 (last column), the estimated effects of SDDS are almost always significant at the 10 percent level and similar in magnitude to HW's original estimates.

Table 4. Placebo Tests: Sensitivity of HW's Results to False SDDS Dates

Deterministic SDDS Date Changes			Random SDDS Date Changes				
SDDS dummy moved to	Estimated Coefficient (λ)	*p*-value	Number of Statistically Significant Results at the 1%, 5%, and 10% levels in 100 Estimations of HW's equation (1) for FDI				
t_0-10	0.63	0.03	*year t_0 (SDDS date unchanged) allowed*				
t_0-9	0.54	0.03					random five-year
t_0-8	0.50	0.02		random changes between			fixed window
t_0-7	0.43	0.01	significance	t_0-10 and t_0+5	t_0-5 and t_0+5	t_0-2 and t_0+2	from t_0-10 to t_0+5
t_0-6	0.44	0.00	1%	16	18	68	19
t_0-5	0.38	0.01	5%	47	49	95	80
t_0-4	0.45	0.00	10%	66	68	100	93
t_0-3	0.56	0.00	average $\hat{\lambda}$	0.27	0.27	0.39	0.33
t_0-2	0.60	0.00					
t_0-1	0.59	0.00	*year t_0 excluded from randomization*				
t_0	0.44	0.00		random changes between			
t_0+1	0.33	0.03	significance	t_0-10 and t_0+5	t_0-5 and t_0+5	t_0-2 and t_0+2 t	t_0-5 and t_0-1
t_0+2	0.17	0.25	1%	17	17	59	84
t_0+3	0.12	0.44	5%	47	50	93	88
t_0+4	0.01	0.93	10%	64	68	99	89
t_0+5	0.06	0.71	average $\hat{\lambda}$	0.26	0.27	0.38	0.46

Source: Authors' calculations using data from HW (2012).

31. These results, taken together with those in Tables 2–3, corroborate our initial conjecture that (typically upward) trends in FDI flows—possibly linked to financial globalization and the increasing liberalization of capital flows across countries—introduce nonstationarity in the data that is not well controlled for by year fixed effects in HW's study.

D. Does SDDS Increase FDI Flows?

32. In this subsection, we update HW's dataset and estimate alternative specifications of their original panel regression. Differently from HW, instead of using period fixed effects, we rely mainly on a set of global control variables to capture factors that are common to all countries. We also normalize FDI inflows by GDP to mitigate nonstationary concerns (Table 5).[19]

[19] Note that, differently from FDI in levels, logs, or deflated by the U.S. GDP deflator, in the case of FDI as a percentage of GDP all panel unit tests reject the null hypothesis of a unit root at the 5 percent significance level. Also, the frequency of rejection is greater in country-by-country tests when FDI is normalized by GDP. We also

33. Following Lane and Milesi-Ferretti (2012), we exclude economies that are either too small (GDP in 2007 less than US$20 billion) or too poor (per capita GDP in 2007 less than US$1,000). We also exclude outliers in FDI inflows.[20] As a result, depending on the set of control variables used, our sample contains between 87 and 106 countries. The effective sample period starts between 1984 and 1991 and ends in 2011.[21]

34. We estimate the following panel regression:[22]

$$fdi_{it} = \beta + \alpha_i + \lambda SDDS_{it} + \theta^* \Psi^*_{\text{it}} + \theta \Psi_{it} + \varepsilon_{it}, \qquad (2)$$

where fdi_{it} is FDI in percent of GDP, β is a constant, α_i is a country-specific fixed effect, $SDDS_{it}$ is the dummy variable for country i that meets the SDDS specifications by year t; Ψ^*_{it} and Ψ_{it} are vectors of global and domestic control variables, respectively;[23] θ^* and θ are vectors of coefficients, and ε_{it} is an error term.

35. The choice of control variables is largely based on recent empirical literature on capital flows and, to some extent, on the IMF's work on current account determination.[24] The set of global variables, Ψ^*_{it}, includes variables to capture liquidity (change in U.S. short-term interest rates) and risk conditions, as well as economic (real GDP) growth in the global economy. It also includes the FDI-to-GDP ratio in the rest of the world (i.e., excluding country *i*). To capture potential heterogeneous effects of these variables across countries we interact them with selected country variables: the change in U.S. interest rates is interacted

performed panel unit root tests on all the regressors discussed below. When evidence of a unit root was found, we transformed the variable to eliminate the problem. The sources—with a detailed description—of all the series used are presented in Annex 1.

[20] Defined as observations that: (i) are deemed "influential" on each country's averages of *both* the change and levels of FDI flows as percentage of GDP—i.e., that by themselves can affect the average in a significant way according to at least three out of seven different "influential statistics" (see Annex 2 for details) *and* (ii) deviate from the trend—obtained from a Hodrick-Prescott (HP) filter—by either more than two standard deviations or more than 5 percent of GDP, whichever is less. Extremely high levels of FDI (above 30 percent of GDP, which is more than seven standard deviations from the sample average) were also excluded.

[21] For comparison, HW's sample contains 70 countries over the 1989–2008 period.

[22] In subsamples for advanced, emerging-market, and low-income economies, after removing regressors that are not statistically significant, the effective sample periods start in 1980, 1991, and 1984, respectively.

[23] We also performed panel unit root tests on all the regressors. When evidence of a unit root was found, we transformed the variable—either by removing its HP trend or by using deviations from the world (cross-country, GDP-weighted) average—to eliminate the problem. See Annex 1.

[24] We particularly relied on the analytical chapter about international capital flows in *WEO* (IMF, 2011), pp. 125–62; Milesi-Ferretti and Tille (2011); Fratzscher (2012); Agosin and Huaita (2012); Forbes and Warnock (2012); and Lane and Milesi-Ferretti (2012). We were also inspired by the choice of variables in the IMF's panel estimations of determinants of the current account used in the External Balance Assessment (IMF, 2013).

with measures of financial depth (FINDEPTH) and financial exposure to the United States (FINEXPOUS), and with an indicator of the use of country i's currency as a reserve currency (RESCUR); the measure of global risk is interacted with Chinn and Ito's (2008) index of capital account openness (FINOPEN) and FINDEPTH; and world real GDP growth is interacted with a measure of trade openness (TRADEOPEN).[25]

Table 5. Unit Root Tests on FDI—Updated Sample

	FDI flows		Log(FDI)		Log(FDI/U.S. GDP deflator)		FDI (% GDP)	
	No Trend	Trend	No Trend	Trend	No Trend	Trend	No Trend	Trend
Panel tests (*p*-values for the null hypothesis of a unit root)								
LLC	1.00	1.00	0.00	0.00	0.02	0.00	0.02	0.00
BTG	n.a	1.00	n.a	0.01	n.a	0.00	n.a	0.00
IPS	1.00	1.00	0.69	0.00	0.12	0.00	0.02	0.00
ADF	1.00	0.50	0.49	0.00	0.03	0.00	0.00	0.00
PP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Country-by-country PP tests (number of countries for which unit root is rejected)								
at 5%	18	28	16	37	21	36	43	43
at 10%	21	30	24	45	31	46	51	56

Source: Authors' calculations.
Note: LLC = Levin, Lin, and Chu (2002); BTG = Breitung (2000); IPS = Im, Pesaran and Shin (2003), ADF = Augmented Dickey-Fuller test and PP = Phillips-Perron tests. See Maddala and Wu (1999) and Choi (2001). Lags selected automatically based on the Modified Schwarz information criterion.

36. Besides the interacting variables mentioned above (except FINEXPOUS), the set of domestic controls, Ψ_{it}, includes the International Country Risk Guide (ICRG) index of political risk (POLRISK), three dummy variables for fixed, "dirty" floating, and floating exchange rate regimes, investment (as a percentage of GDP), five-year-ahead *World Economic Outlook (WEO)* growth forecasts, per capita GDP (relative to that of the U.S.), change in the net foreign asset (NFA) position (as percentage of GDP), the deviation of the PPP-based real exchange rate from a smooth (Hodrick-Prescott, HP) trend, and a dummy variable for foreign exchange crises.

37. Table 6 shows the estimation results for several variants of equation (2). To account for potential endogeneity problems, we also estimate the model using a just-identified GMM estimator in which potentially endogenous variables—typically, the domestic controls variables—are instrumented for by their lags. In addition, across the different specifications, we include common first-order autoregressive terms and linear time trends to capture stochastic or deterministic time dependency not reflected in the global control variables. For robustness, we also show the results from a specification that uses year fixed effects and country-specific autoregressive terms and trends.

[25] For the U.S. interest rates, we use the principal component of the Federal Funds Rate and three-month Treasury bill (T-Bill). Global risk is the principal component of the VIX index of market volatility and TED spreads. Trade openness is expressed in deviations from its cross-country GDP-weighted average to correct for a unit root. See Annex 1.

38. First, note that the SDDS dummy is never statistically significant at the 10 percent level in any of the specifications, including when we search for statistically significant variables in equation (2) on subsamples for advanced (AE), emerging-market (EME), and low-income (LIC) economies.[26] Second, to a large extent, OLS and GMM estimations are mutually consistent, which suggests that endogeneity problems are contained. Third, time-dependency is important: both linear trends and AR (1) terms seem to matter for FDI inflows.

39. Fourth, overall, the estimated coefficients associated with the control variables, when statistically significant, show the expected sign:[27]

- Increases in the interest rates in the United States have a negative effect on FDI inflows that is somewhat mitigated in countries that have deeper financial markets and whose currencies are largely held as foreign reserves by other countries.

- Global risk does not seem to have a symmetric effect on FDI inflows to all countries: its negative effect is only significant when domestic control variables are omitted or when the sample is split along levels of development—it negatively affects FDI inflows in all countries, but in both EMEs and LICs it only does so in combination with greater financial openness. Moreover, the negative effect of global risk is typically mitigated by greater financial depth.

- World GDP growth has an overall negative effect on FDI inflows, but this is largely attributable to its effect on AEs: when we split the sample by country income group, its effect is only negative and statistically significant in the AE subsample. In addition, the negative effect of world GDP growth is reversed in economies with high degrees of trade openness (or, at least, largely offset, as in the subsample for AEs). This result provides some evidence that in a growing world economy, FDI flows tend to be diverted from AEs to less developed economies, especially those that are more open to trade.

- Trade and financial openness, as well as financial depth, typically help to increase FDI inflows. The positive effect of trade openness, especially in AEs, is noteworthy.

- Both the investment rate and the five-year-ahead forecasts of real GDP growth—indicators of future growth—have positive effects on FDI inflows. Moreover, levels

[26] We also estimated the baseline model using the full sample, but allowing the SDDS effect to differ across these country groupings. No statistically significant SDDS-related coefficient was found either.

[27] Regarding the effect of FDI inflows reported in Table 6, unexpected coefficient signs are rare: a positive effect of global risk in the OLS estimation for the subsample of EMEs; a negative effect of the investment rate in both the GMM estimation with period effects and country-specific AR(1) and trends— which also shows an unexpected negative effect of the change in NFA position—and in the OLS estimation for the subsample of AEs; and, finally, a negative effect of the real exchange rate in the OLS estimation with period effects and country-specific AR(1) and trends.

of the PPP-adjusted real exchange rate that are above trend—i.e., domestic assets tend to be relatively cheaper to foreign investors—are associated with higher ratios of FDI inflows to GDP.

E. Summary

40. The results in this section suggest that the findings in HW (2012) are not solid. They seem to largely overestimate the effect of SDDS on FDI inflows, and they crucially depend on a specific (and controversial) transformation imposed on the data on FDI inflows.

41. This transformation (i) potentially introduces trends in the data that are orthogonal to FDI inflows and mainly driven by inflation, and (ii) distorts the econometric strategy—use of period fixed effects—used to control for common (global) factors that may affect FDI inflows worldwide.

42. In addition, HW do not give careful consideration to the time-dependency and nonstationarity observed in FDI inflows. This may lead to a misspecified empirical strategy. Placebo tests, in which the true SDDS subscription dates are replaced by false dates, support this hypothesis: a similar effect of SDDS on FDI inflows reported in HW (2012), using their own dataset and model, can be found even ten years before countries actually meet the requirements to subscribe to SDDS. These "false positives" are an indication that there is nothing special about the dates of SDDS subscription in regard to its effect on FDI inflows.

43. Furthermore, when a different transformation (i.e., normalization by GDP) is used—with a view to mitigating unit root problems that are common in gross capital flows data and were not accounted for by HW—and proper account of time-dependency is taken in the econometric strategy, the results in HW (2012) do not hold: no statistically significant effect of SDDS on FDI inflows is found across several specifications of our econometric model, or when using HW's own model.

IV. The Reserve Template and the Volatility of Exchange Rates

44. This section studies the potential effects of the adoption of the IMF's Data Template on International Reserves and Foreign Currency Liquidity (the "Reserves Template," RT) on exchange rate volatility. It builds on Cady and Gonzalez-Garcia (2007)—henceforth CGG—by performing additional robustness checks using their dataset. We also present new evidence based on different specifications of alternative econometric models applied to an updated sample. The goal is to test the robustness of CGG's finding that the adoption of the RT—a component of the SDDS since April 2000 for the dissemination of data on foreign liquidity positions—is associated with a 20 percent decrease in exchange rate volatility.

Table 6. Estimation Results—FDI (Percent of GDP)

	Common AR(1) and trend, Country Fixed-Effects											
Model	Global Variables				Policy Intervention				Macro Fundamentals (1)			
	OLS		GMM		OLS		GMM		OLS		GMM	
Variable	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*
C	0.07	0.92	0.08	0.92	-5.20	0.00	-6.14	0.00	-10.45	0.00	-10.56	0.00
SDDS	-0.17	0.67	-0.35	0.41	-0.43	0.29	-0.63	0.14	-0.29	0.50	-0.51	0.27
Δ U.S. int. rate (Δi_{US})	-0.39	0.09	-0.54	0.04	-0.49	0.05	-0.74	0.01	-0.66	0.05	-0.92	0.01
Δi_{US} × FINDEPTH	0.01	0.09	0.01	0.08	0.01	0.01	0.01	0.00	0.01	0.01	0.02	0.00
Δi_{US} × RESCUR	1.04	0.10	0.77	0.29	1.13	0.08	0.83	0.24	1.20	0.07	1.03	0.15
Δi_{US} × FINEXPOUS	0.15	0.81	0.48	0.50	-0.08	0.90	0.09	0.90	-0.26	0.70	-0.12	0.88
Global risk (μ)	0.01	0.98	-0.17	0.63	-0.09	0.78	-0.29	0.41	-0.64	0.20	-0.83	0.12
μ × FINOPEN	-0.12	0.15	-0.22	0.02	-0.11	0.23	-0.20	0.05	-0.05	0.64	-0.09	0.45
μ × FINDEPTH	0.01	0.16	0.01	0.06	0.01	0.05	0.01	0.01	0.01	0.01	0.02	0.00
World GDP growth (g_w)	-0.46	0.00	-0.52	0.00	-0.33	0.00	-0.25	0.02	-0.39	0.00	-0.30	0.02
g_w × TRADEOPEN	0.60	0.00	0.71	0.00	0.44	0.00	0.38	0.00	0.47	0.00	0.40	0.00
Rest of the World FDI/GDP	0.57	0.00	0.61	0.00	0.56	0.00	0.57	0.00	0.57	0.00	0.50	0.02
POLRISK (*)					0.05	0.00	0.05	0.01	0.04	0.10	0.05	0.07
Exc. Rate Regime: FIX					0.39	0.20	0.35	0.32	0.41	0.27	0.22	0.60
Exc. Rate Reg.: Dirty FLOAT					0.27	0.32	0.31	0.31	0.27	0.40	0.15	0.67
Exc. Rate Regime: FLOAT					0.16	0.58	0.08	0.79	0.07	0.82	-0.11	0.74
TRADEOPEN (*)					3.63	0.00	5.33	0.00	5.51	0.00	8.68	0.00
FINOPEN (*)					0.26	0.10	0.21	0.22	0.30	0.15	0.34	0.13
FINDEPTH					0.03	0.00	0.04	0.00	0.04	0.00	0.04	0.00
RESCUR					1.02	0.47	1.11	0.45	0.67	0.66	1.02	0.51
INV / GDP (*)									0.13	0.00	0.10	0.11
5-Y GROWTH FORECAST									0.40	0.00	0.53	0.00
RELATIVE PER CAPITA GDP									0.00	0.90	-0.06	0.22
ΔNFA / GDP												
RER PPP (*)												
FX CRISIS												
@TREND	0.07	0.03	0.06	0.08	0.02	0.67	0.02	0.54	0.02	0.70	0.04	0.34
AR(1)	0.42	0.00	0.43	0.00	0.39	0.00	0.40	0.00	0.34	0.00	0.35	0.00
Periods	28		28		27		27		21		21	
Cross-sections	92		92		88		88		88		88	
Observations	2054		2054		1914		1914		1554		1554	
Adj. R^2	0.58		0.58		0.59		0.59		0.59		0.58	
Normality: Nb. of countries	52		53		53		55		68		70	

	Common AR(1) and trend, Country Fixed-Effects				Country-specific AR(1) and trends,				Baseline Model (Search Routine with 10% significance)			
Model	Macro Fundamentals (2)				Country and Year Fixed-Effects				Full Sample			
	OLS		GMM		OLS		GMM		OLS		GMM	
Variable	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*
C	-9.53	0.00	-9.87	0.00	-5.10	0.35	-2.89	0.69	-5.34	0.00	-6.96	0.00
SDDS	-0.20	0.65	0.04	0.94	-0.29	0.56	-0.80	0.18				
Δ U.S. int. rate (Δi_{US})	-0.65	0.06	-0.83	0.04					-0.44	0.01	-0.62	0.01
Δi_{US} × FINDEPTH	0.01	0.01	0.02	0.00	0.01	0.02	0.01	0.01	0.01	0.00	0.02	0.00
Δi_{US} × RESCUR	0.78	0.25	0.81	0.32	-0.50	0.57	-0.46	0.65	1.20	0.04		
Δi_{US} × FINEXPOUS	-0.08	0.91	0.15	0.86	0.49	0.58	0.42	0.69				
Global risk (μ)	-0.55	0.27	-0.44	0.47								
μ × FINOPEN	-0.06	0.58	-0.14	0.30	-0.11	0.35	-0.05	0.75				
μ × FINDEPTH	0.01	0.02	0.02	0.01	0.01	0.04	0.01	0.02	0.01	0.01	0.01	0.00
World GDP growth (g_w)	-0.36	0.00	-0.32	0.02					-0.28	0.00	-0.28	0.01
g_w × TRADEOPEN	0.47	0.00	0.46	0.00	0.42	0.00	0.43	0.00	0.45	0.00	0.44	0.00
Rest of the World FDI/GDP	0.50	0.00	0.40	0.04					0.45	0.00	0.31	0.04
POLRISK (*)	0.04	0.16	0.05	0.08	-0.02	0.37	0.02	0.61			0.04	0.10
Exc. Rate Regime: FIX	0.44	0.23	0.24	0.58	0.54	0.11	0.66	0.14				
Exc. Rate Reg.: Dirty FLOAT	0.27	0.40	-0.03	0.93	0.39	0.22	0.63	0.11				
Exc. Rate Regime: FLOAT	0.08	0.80	-0.18	0.64	0.28	0.37	0.48	0.24				
TRADEOPEN (*)	5.20	0.00	6.66	0.00	2.54	0.02	4.88	0.08	4.44	0.00	6.19	0.00
FINOPEN (*)	0.32	0.13	0.50	0.04	0.07	0.72	0.38	0.13	0.35	0.03	0.56	0.01
FINDEPTH	0.05	0.00	0.06	0.00	0.00	0.75	-0.01	0.81	0.04	0.00	0.05	0.00
RESCUR	-0.50	0.75	-1.41	0.43	1.38	0.48	5.08	0.13				
INV / GDP (*)	0.13	0.00	0.14	0.04	0.09	0.00	-0.18	0.03	0.13	0.00	0.12	0.06
5-Y GROWTH FORECAST	0.41	0.00	0.48	0.00	0.46	0.00	0.50	0.00	0.25	0.00	0.39	0.00
RELATIVE PER CAPITA GDP	-0.02	0.59	-0.07	0.14	0.01	0.74	0.02	0.74			-0.10	0.02
ΔNFA / GDP	0.00	0.98	0.15	0.05	-0.02	0.19	-0.24	0.09			0.11	0.05
RER PPP (*)	0.17	0.76	2.28	0.05	-0.84	0.04	-0.45	0.75			2.26	0.02
FX CRISIS	0.36	0.46	-0.67	0.82	0.44	0.32	3.41	0.44				
@TREND	0.02	0.68	-0.01	0.92					0.01	0.86	0.01	0.75
AR(1)	0.33	0.00	0.35	0.00					0.37	0.00	0.36	0.00
Periods	21		21		22		22		21		21	
Cross-sections	87		87		87		87		106		100	
Observations	1532		1532		1623		1609		1843		1707	
Adj. R^2	0.59		0.55		0.66		0.55		0.59		0.57	
Normality: Nb. of countries	66		64		68		62		75		74	

	Baseline Model (Search Routine with 10% significance)											
Model	Advanced Economies				Emerging Mkt Economies				Low-Income Economies			
	OLS		GMM		OLS		GMM		OLS		GMM	
Variable	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*
C	-1.87	0.38	-4.35	0.01	-5.41	0.00	-0.02	0.99	-3.45	0.00	-1.10	0.04
SDDS												
Δ U.S. int. rate (Δi_{US})					-0.49	0.11	-0.94	0.01				
Δi_{US} × FINDEPTH					0.01	0.07	0.02	0.01				
Δi_{US} × RESCUR												
Δi_{US} × FINEXPOUS												
Global risk (μ)			-0.50	0.07	0.40	0.05						
μ × FINOPEN							-0.24	0.05			-0.26	0.01
μ × FINDEPTH									0.01	0.01		
World GDP growth (g_w)	-0.41	0.00	-0.57	0.00	0.12	0.03						
g_w × TRADEOPEN	0.38	0.00	0.34	0.00					0.22	0.02	0.20	0.03
Rest of the World FDI/GDP	1.49	0.00	1.61	0.00								
POLRISK (*)												
Exc. Rate Regime: FIX	0.70	0.06	0.77	0.06								
Exc. Rate Reg.: Dirty FLOAT					0.36	0.10	0.46	0.08				
Exc. Rate Regime: FLOAT												
TRADEOPEN (*)	6.97	0.00	9.37	0.00	4.89	0.00						
FINOPEN (*)					0.45	0.01	0.51	0.02				
FINDEPTH	0.04	0.00	0.05	0.00								
RESCUR												
INV / GDP (*)	-0.09	0.10			0.19	0.00			0.03	0.04		
5-Y GROWTH FORECAST					0.21	0.01	0.52	0.00	0.30	0.06		
RELATIVE PER CAPITA GDP					-0.07	0.02	-0.12	0.02				
ΔNFA / GDP												
RER PPP (*)												
FX CRISIS												
@TREND	-0.09	0.08	-0.13	0.08	0.09	0.01	0.09	0.01	0.12	0.00	0.11	0.00
AR(1)	0.24	0.00	0.23	0.00	0.50	0.00	0.54	0.00	0.66	0.00	0.70	0.00
Periods	32		32		21		21		40		40	
Cross-sections	29		29		57		57		19		19	
Observations	785		786		938		938		502		526	
Adj. R^2	0.64		0.64		0.63		0.58		0.77		0.77	
Normality: Nb. of countries	13		13		43		49		8		7	

Source: Authors' calculations.

Note: (*) indicates that the same or similar series were used in HW (2012); *p*-values computed using robust standard errors (cross-section clustering). Yellow highlighted cells are statistically significant.

A. Cady and Gonzalez-Garcia (2007)

45. Using a quarterly data set from 48 industrial, emerging market, and low-income countries over the period 1991–2005, CGG estimate a panel regression of the (log) volatility of the nominal exchange rate on a set of fundamental macroeconomic variables and a dummy variable that indicates the adoption of the RT. The CGG panel regression is:

$$log\, V_{it} = \beta + \alpha_i + \eta_t + \lambda_1 RT_{it} + \lambda_2 RT_{it} * D_{it} + \lambda_3 RT_{it} * RA_{it} + \theta \Psi_{it} + AR_i(1) + \mu\, Time + \varepsilon_{it}, \quad (3)$$

where V_{it} is the nominal exchange rate volatility in country *i*, year *t*; β is a constant; α_i and η_t are country-specific and period fixed effects, respectively; RT_{it} takes the value of one if country i uses the Reserves Template at year *t*; Ψ_{it} is a vector of control variables—including measures of indebtedness (D_{it}, in logs), reserve adequacy (ratio of international reserves to short-term external debt, RA_{it}, in logs), and dummy variables for exchange rate regimes. These are interacted with RT_{it} to capture potential non-linear effects related to the use of the Reserves Template;[29] $AR_i(1) = \gamma_i\, log\, V_{it-1}$ are country-specific autoregressive terms; $Time$ is a time trend; and ε_{it} is an error term.

46. The direct, (log) linear effect of the Reserves Template on exchange rate volatility is captured by the parameter λ_1. CGG (2007) find that RT is associated with a 20 percent decrease in nominal exchange rate volatility based on this linear effect alone. However, the *total* marginal effect of RT—including the non-linear effects associated with D_{it} and RA_{it}—is time-varying because of the interaction terms, and given by $e^{(\lambda_1 + \lambda_2 D_{it} + \lambda_3 RA_{it})} - 1$.

47. Table 7, constructed using CGG's original data and estimations, shows the total marginal effect of the "treatment" (RT use) on the "treated" (i.e., countries for which $RT = 1$ at some point in time) when computed at mean and median values of D_{it} and RA_{it}, as well as for different quartiles. Based on both the mean and the median, the "typical" value of the total RT effect is negative (-6.8 percent and -7.9 percent, respectively), but not statistically significant at the 10 percent level or less. Thus, when considering the total effect of RT (rather than just its direct, linear effect), CGG's original results actually *do not* support the conclusion that adoption of the Reserves Template reduces exchange rate volatility. There is however, a negative and significant effect (-17.5 percent) for countries with high levels of both indebtedness and reserves (high values of D_{it} and RA_{it}) in the last quartile of their distributions.

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[29] The dates of countries' adoption of the Reserves Template that were used to construct the dummy variable RT were obtained from IMF records. Other variables in Ψ_{it} are changes in fiscal balances; real GDP growth; CPI inflation; volatility of money growth; current account balance; a measure of the economy's openness to trade; and dummy variables indicating periods of fixed exchange rates and periods of "managed" floating or intervention. See CGG (2007), pp. 752–53 for a description of the data.

Table 7. CGG's Estimated Total Effect of RT on Exchange Rate Volatility

RT-Related Estimated Coefficients		Total Effects	
Reserves Template(RT_{it}) = λ_1	-0.20	Mean D_{it}	-0.35
	(0.07)	Mean RA_{it}	-1.04
		Marginal effect of RT at mean $\{D, RA\}$ (1)	-6.8%
RT_{it} × Debt/GDP ratio (D_{it}), = λ_2	-0.14		(0.42)
	(0.01)		
		Median D_{it}	-0.57
RT_{it} × Reserve Adequacy (RA_{it}) = λ_3	-0.08	Median RA_{it}	-0.47
	(0.07)	Marginal effect of RT at median $\{D, RA\}$	-7.9%
			(0.12)

Marginal Effects at different values of D_{it} and RA_{it}

		RA_{it} First Quartile	RA_{it} Median	RA_{it} Third Quartile
D_{it}	First Quartile	8.3%	-2.7%	-7.4%
		(0.49)	(0.76)	(0.41)
	Median	2.5%	-7.9%	-12.3%
		(0.80)	(0.12)	(0.16)
	Third Quartile	-3.6%	-13.4%	-17.5%
		(0.69)	(0.11)	(0.05)

Source: Authors' calculations using data and estimation results from CGG (2007).
Notes: (1) Effects at the mean and median are calculated as $\left(e^{\lambda_1+\lambda_2\bar{D}_{it}+\lambda_3\overline{RA}_{it}}-1\right)$ x 100, where $\bar{X}$ indicates the mean or median of X. The associated *p*-values (in parenthesis) refer to Wald tests and are computed using the delta method.

B. Data Issues

48. We identified problems with the series used in CGG (2007) as indicators of indebtedness and reserve adequacy. These are crucial variables for the assessment of the total effect of SDDS on the volatility of the exchange rate in CGG's model, since they are interacted with the RT dummy and are reported as having statistically significant effects on exchange rate volatility.

49. Indebtedness, D_{it}, is measured as (the log of) either government debt or external debt, as a percent of GDP.[30] In the original dataset, there are mismatches of both currency and frequency in constructing the ratios to GDP. For instance, CGG (2007) mistakenly divide government debt *in local currency* by nominal GDP *in U.S. dollars*. In addition, they use annual data on government and external debt, repeated every quarter within a year, and quarterly GDP data to construct the series of indebtedness. This strategy may be problematic if the quarterly GDP series is not "annualized" by, say, the moving sum of the previous four quarters. For some countries (e.g., Germany), the quarterly GDP series from the IMF's

[30] CGG uses the government debt-to-GDP ratio for advanced countries, and external debt otherwise.

International Financial Statistics (IFS)—the source of the GDP data used in CGG (2007)—represents the flow of GDP *within* the quarter and is, therefore, not annualized. In these cases, annual GDP is the sum of quarterly GDP.[31] For the same level of annual debt, the computed debt-to GDP ratio in these cases will be overestimated by a factor of about four.

50. The reserve adequacy series, RA_{it}, used in CGG also suffers from currency mismatch. It is primarily computed as the (log of the) ratio of international reserves holdings (expressed in U.S. dollars) to short-term external debt (also in U.S. dollars), but when that series is not available government debt expressed in domestic currency is used.

51. Finally, CGG use quarterly data without seasonal adjustment, and thus it may contain unnecessary noise that reduces the accuracy of the estimations. In our robustness checks applied to the original data and in new estimations using an updated sample (see the next two subsections), we correct the above-mentioned potential problems with the series for D_{it} and RA_{it}, and assess the effect of seasonal adjustment on the original results.

C. Robustness Checks

52. Two types of robustness checks based on CGG's original dataset, sample period, and estimated equation are discussed: (i) placebo estimations (dates when countries start using the RT are replaced by counterfactual, false dates), and (ii) new estimations of equation (3) in which we use the original CGG dataset and same sample period while including more countries in the sample, correcting the problems identified above in the series of D_{it} and RA_{it}, and using seasonally adjusted data.

"Placebo" estimations

53. Table 8 shows the results from placebo estimations similar to those discussed in the previous section. Because of the interaction terms in equation (3), placebo tests are not as reliable as those reported in the previous section.[32]

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[31] This is not the case, for example, with the *IFS* data on GDP for the United States.

[32] This is because the estimated coefficient of RT can flip signs when interacted with a variable *X* that, by itself, is also correlated to the dependent variable. This correlation—if it is significant prior to when SDDS subscription begins, contaminates the interaction terms, affects the estimated coefficient on RT, and biases the placebo tests towards showing significant RT coefficients prior to treatment. Therefore, "passing" the test becomes more difficult and, therefore, provides a clear indication that RT dates are meaningful in terms of explaining the dependent variable. "Failing" the test, however, may be a consequence of the distortion just explained and must be taken with caution.

Table 8. Placebo Tests: Sensitivity of CGG's Results to False RT Adoption Dates

Deterministic RT Date Changes			Random RT Date Changes				
RT dummy moved to	Estimated Coefficient (λ_1)	*p*-value	Number of Statistically Significant Results at the 1%, 5%, and 10% levels in 100 Estimations of CGG's equation (3)				
t_0-10	-0.04	0.67	*year t_0 (RT date unchanged) allowed in randomization*				
t_0-9	0.02	0.84		random changes between			
t_0-8	-0.02	0.86	significance	t_0-10 and t_0+5	t_0-5 and t_0+5	t_0-2 and t_0+2	t_0-5 and t_0-
t_0-7	-0.01	0.93	1%	8	15	13	0
t_0-6	-0.02	0.81	5%	14	31	27	3
t_0-5	-0.11	0.29	10%	22	43	42	13
t_0-4	-0.11	0.25	average $\hat{\lambda}1$	-0.12	-0.15	-0.16	-0.07
t_0-3	-0.04	0.66					
t_0-2	-0.10	0.34	*year t_0 excluded from randomization*				
t_0-1	-0.02	0.82		random changes between			
t_0	-0.20	0.07	significance	t_0-10 and t_0+5	t_0-5 and t_0+5	t_0-2 and t_0+2	t_0-5 and t_0-
t_0+1	-0.35	0.00	1%	9	11	32	5
t_0+2	-0.18	0.09	5%	12	22	35	8
t_0+3	-0.26	0.02	10%	17	26	38	12
t_0+4	-0.18	0.10	average $\hat{\lambda}_1$	-0.07	-0.11	-0.17	-0.04
t_0+5	-0.21	0.05					

Source: Authors' calculations using data from CGG (2007).

54. Nevertheless, in contrast to the placebo tests of the results in HW (2012), the test results reported here indicate that the treatment variable (i.e., *RT*) *is* robust to both deterministic and random placebos: when false *past* RT dates are used, the effect of RT on exchange rate volatility ceases to be statistically significant; similarly, when RT dates change randomly only backwards (last column), the frequency of statistically significant estimates of the RT effect becomes very low; but when the false RT dates come *after* the true date (t_0), the RT effect remains significant (at 10 percent or less). Therefore, the treatment only works at or after t_0, but never before it was actually implemented, suggesting that there is something special about the (true) RT dates in regard to the effect of the RT on the volatility of the exchange rate.

Additional robustness checks

55. Table 9 shows the results of additional robustness checks on CGG's estimations. For convenience, their original results are also shown (column 2). Using CGG's dataset, we first estimate their model using no interaction terms to show how important these terms are for the sign and significance of the RT coefficient. Their exclusion from equation (3) eliminates the effect of RT on exchange rate volatility, as the RT coefficient ceases to be significant, while the coefficients on the other regressors remain similar to the original estimates (column 3).

56. A second set of robustness checks relates to the way CGG control for different exchange rate regimes in their econometric model. This is a crucial step in any cross-country study of exchange rate volatility. CGG included dummy variables for different exchange rate regimes that they constructed following the classification approach of Levy-Yeyati and

Sturzenegger (2005)—LYS, for short.[33,34] That approach considers fluctuations in the exchange rates of national currencies against a benchmark currency, but not necessarily the U.S. dollar, which is the currency of reference for the exchange rate volatility used in CGG (2007).[35] If a given currency is pegged to another currency that freely floats against the U.S. dollar, it is not clear whether the former should be classified as pegged when the reference is the U.S. dollar. This may be a problem in CGG, in which the dependent variable is always measured against the U.S. dollar.

Table 9. Robustness to Alternative Set of Control Variables and Sample

	Original CGG data and sample (same countries and period)						Original data and sample period	
Variable	CGG original results	CGG, no interactions	Alternative exchange rate regime dummies	Volatility of benchmark currency *vs*. US$	Corrected D_{it} and RA_{it}	HP-detrended D_{it}	Additional countries	Additional countries and HP-detrended D_{it}
Reserves Template(RT_{it}), λ_1	-0.20	-0.07	-0.25	-0.20	-0.32	-0.03	-0.17	-0.03
	(0.07)	(0.46)	(0.01)	(0.06)	(0.02)	(0.78)	(0.16)	(0.72)
RT_{it} × Debt/GDP ratio (D_{it}), λ_2	-0.14		-0.15	-0.15	-0.20	-0.42	-0.05	-0.57
	(0.01)		(0.00)	(0.01)	(0.11)	(0.33)	(0.64)	(0.29)
RT_{it} × Reserve Adequacy (RA_{it}), λ_3	-0.08		-0.08	-0.08	-0.04	0.02	-0.02	0.03
	(0.07)		(0.05)	(0.05)	(0.34)	(0.42)	(0.61)	(0.27)
Fixed exchange rate regimes	-0.33	-0.31	-0.90	-0.33				
	(0.00)	(0.00)	(0.00)	(0.00)				
Dirt floating exc. rate regimes	-0.14	-0.12	0.37	-0.14				
	(0.02)	(0.04)	(0.00)	(0.02)				
Floating exchange rate regime			0.24					
			(0.00)					
Volatility of the benchmark currency against the USD (V^*_{it})				0.96				
				(0.00)				

Source: Authors' calculations using data from CGG (2007), *WEO,* and *IFS*.

57. To account for possible problems associated with the use of LYS methodology, we estimate CGG's model using (i) an alternative set of dummy variables for the exchange rate regimes based on a modified version of the LYS approach in which the U.S. dollar is always the reference (column 4); and (ii) CGG's original dummy variables combined with a measure of the volatility of the benchmark currency against the U.S. dollar as an additional regressor (column 5). We find that CGG's model is robust to both changes—estimated coefficients on

[33] Fixed and managed ("dirty") floating exchange rate regimes are explicitly included in CGG's model, while fully flexible and "inconclusive" regimes, combined, form the reference category captured by the constant.

[34] The LYS approach relies on "clustering" observations along four mutually exclusive categories—fixed, managed float, float, and "inconclusive." Depending on the changes in nominal exchange rates (level and volatility), international reserves, and money base for country *i* at year *t*, observations are sorted into these four categories.

[35] For example, the Austrian schilling is classified by CGG as following a fixed exchange rate against the Deutsch mark over the period 1989–98. Accordingly, CGG assigned values of one and zero, respectively, to the dummy variables for fixed and dirty floating exchange rate regimes.

the key variables are very similar to the original, while the coefficients on the new variables are both significant and show the expected signs.

58. Third, we re-estimate CGG's model using "corrected" series of D_{it} and RA_{it} (column 6). Since data for indebtedness are available at annual frequency, we use annual GDP in U.S. dollars to compute D_{it}, when it represents the external debt-to-GDP ratio, and annual GDP in domestic currency when D_{it} represents the government debt-to-GDP ratio. For RA_{it}, we use the quarterly series of foreign reserve holdings as a percentage of the annual stocks (repeated every quarter) of short-term external debt or, when that series is not available, total external debt.[36] Both series are transformed using logs. When these corrections are applied, the coefficients of the interaction terms are no longer significant, but the estimated coefficient of RT remains negative and significant, in line with CGG's original conclusions.

59. However, because our corrected series of indebtedness was found to be nonstationary,[37] we also estimate the model using an HP-detrended series of D_{it} (column 7). In this case, all RT-related coefficients become statistically insignificant, in contradiction of CGG's original results.

60. Finally, we estimate the model over an extended sample that includes up to 14 additional countries, while covering the original sample period in CGG (2007). In Table 9, columns 8 and 9 show specifications using the corrected series of D_{it} without and with detrending, respectively. Unlike in CGG (2007), none of the RT-related coefficients remains negative and significant.

61. These results, especially those obtained using data that have been cleaned from the misconstructions noted in subsection III.B above, cast doubt on the robustness of the CGG estimates. In any case, even if one accepts the original CGG estimates of equation (3), as discussed in subsection III.A, one cannot conclude that the Reserve Template has had a statistically significant effect on the volatility of exchange rates.

D. Does the Reserve Template Reduce Exchange Rate Volatility?

62. In this subsection, we estimate alternative versions of equation (3) using a different set of domestic control variables and an updated sample—extended to include eight more years of data (up to 2013) and up to 22 new countries. As in the previous section, we present results from both pooled OLS and GMM estimations to mitigate endogeneity concerns, and

[36] Like CGG (2007), we use data on gross government debt positions and external debt stocks from the *WEO* database. Data on annual GDP in U.S. dollars also come from the *WEO*, while those on annual GDP in domestic currency and foreign reserve holdings come from the *IFS*. See Annex 1.

[37] The *p*-values for the rejection of the null hypothesis of nonstationarity according to three types of panel unit root tests—Levin, Lin, and Chu (2002); Im, Pesaran and Shin (2003); and the Augmented Dickey-Fuller (ADF) tests, henceforth LLC, IPS, and ADF, respectively—are 0.08, 0.22, and 0.13, respectively.

exclude very small and very poor economies from the sample. We also exclude outliers in the regressors, seasonally adjust the relevant quarterly data, and correct the previously discussed misconstructions in some series.[38]

63. Our version of vector Ψ_{it} includes variables used by CGG—the dummy variables for fixed, managed floating, and floating exchange rate regimes, the volatility of money supply (M2), real GDP growth, the current account and (the first difference of) government balances, both as percentages of GDP, and a dummy variable for foreign exchange crises. We further add (i) ICRG indexes of political and financial risks (POLRISK and FINRISK, respectively), (ii) policy indicators discussed in the previous section (i.e., TRADEOPEN, FINOPEN, and FINDEPTH), and (iii) other indicators of macroeconomic fundamentals: the log-deviation of the real GDP level from its HP-trend (OUTPUT GAP, meant to capture the effects of the business cycle), the interest rate differential (relative to the U.S.), as well as the domestic CPI inflation rate and its standard deviation.[39] For the reasons explained in subsection III.C, we include the volatility of the reference currency used in the LYS procedure against the U.S. dollar as an additional regressor in vector Ψ_{it}.

64. In addition, following CGG (2007), measures of indebtedness, D_{it}, and reserve adequacy, RA_{it}, are included in the estimation, both separately and as interacted with the treatment variable, RT_{it}. Indebtedness is included as in the original definition of CGG (2007)—government debt, for industrialized economies, and external debt, otherwise—but computed in deviations from a smooth HP trend to eliminate the nonstationarity found in the data.[40] For robustness, we also consider one specification that uses only government debt as the measure of indebtedness. Two definitions of reserve adequacy are used: (i) reserves as a percentage of short-term debt (STD) or government debt (converted to U.S. dollars), as in CGG (2007); or, (ii) reserves as a percentage of short-term debt, total external debt (if STD is not available), or government debt (if the previous series are not available). The alternative definition aims at reducing the weight of government debt—already a component of D_{it}—in the measure of reserve adequacy, which ideally should capture countries' ability to service external payments.[41]

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[38] See Annex 1.

[39] For series available on an annual basis, we repeat the value in all quarters within a year, which implies that they may not account for much of the time series variation, but can help capture the cross-country variation in the transmission of shocks to FDI. See Annex 1.

[40] Over the updated sample, the null hypothesis of a panel unit root in D_{it} (in both levels and logs) cannot be rejected at standard levels. The p-values in LLC, IPS, and ADF tests in levels (logs) are 0.13 (0.30), 1.00 (1.00), and 0.75 (0.56), respectively. RA_{it}, on the other hand, seems stationary: either in levels or logs, p-values are always below 0.01.

[41] This may be an issue when reserve adequacy is computed as the ratio to government debt, since not all debt is external.

65. The results are shown in Table 10. All specifications use country fixed effects, a common linear trend, and country-specific AR(1) terms, following CGG (2007). All but one specification use period fixed effects. OLS and GMM versions are presented. Columns 2–9 refer to the authors' original specification of equation (3), either using the original or the alternative measure of RA_{it} discussed above. Columns 10–13 refer to estimations using our extended version of vector Ψ_{it} and a detrended measure of D_{it}. The same applies to columns 14–17, but without the interaction terms with RT_{it}. In columns 18–21, we use (detrended) government debt as a percentage of GDP instead of D_{it}, and the alternative version of RA_{it}, while in columns 22–25 we replace the period fixed effects by global control variables.[42] Finally, the remaining columns show specifications resulting from a search routine that successively eliminates variables not statistically significant at the 10 percent level—applied to the full sample and also to subsamples for advanced and emerging-market economies.

66. We highlight three main points from Table 10. First, the negative estimated value of λ_1 reported in CGG (2007) is not always confirmed: i.e., it is not negative or not statistically significant at 10 percent or less. In particular, this result is not observed when we use either (i) the original CGG specification, or (ii) the extended list of regressors without interaction terms, or (iii) global variables to control for common factors. Negative and significant estimates of λ_1 are found, however, in the parsimonious model resulting from the search routine but, oddly, mainly because of advanced economies.[43]

67. Second, across different specifications, the estimated values of λ_2 and λ_3, differ widely from the original CGG results. In the case of λ_2, except when government debt is used to represent indebtedness (with global control variables), the estimates are never significant. The estimates of λ_3 turn positive and statistically significant in most specifications.

68. Finally, and more importantly, in all specifications the estimated *total* effect of *RT* on the volatility of exchange rates, measured at either the mean or the median values of indebtedness and reserve adequacy, is not statistically significant.

[42] We included measures of U.S. monetary policy (both change and "surprises" in the Federal Funds Rate), global risk (VIX market volatility index, in logs), and volatility (standard deviation) of both oil prices and world real GDP growth.

[43] It is reasonable to think that the increased transparency effect of the reserve template would not come from countries that presumably are already relatively more transparent regarding data.

Table 10. Estimation Results—Exchange Rate Volatility

Model	Original CGG specification: Original *D* and *RA* — OLS Coef.	OLS *prob.*	GMM Coef.	GMM *prob.*	Original *D*, alternative *RA* — OLS Coef.	OLS *prob.*	GMM Coef.	GMM *prob.*	Extended set of control variables: *D* (detrended) and *RA* — OLS Coef.	OLS *prob.*	GMM Coef.	GMM *prob.*
C	-2.22	0.00	5.26	0.46	-2.30	0.00	-0.92	0.19	-1.80	0.00	1.38	0.33
Reserves Template, *RT* (*)	0.06	0.70	0.14	0.71	0.02	0.88	0.09	0.80	-0.16	0.03	-0.21	0.10
RT × *D* (*)	-0.05	0.19	-0.05	0.50	-0.04	0.22	-0.05	0.49	0.00	0.43	0.00	0.65
RT × *RA* (*)	0.03	0.10	0.01	0.59	0.03	0.04	0.02	0.33	0.04	0.01	0.05	0.06
Indebtedness, *D* (*)	0.05	0.21	0.06	0.29	0.07	0.06	0.07	0.18	0.00	0.32	0.00	0.83
Reserve adequacy, *RA* (*)	-0.05	0.02	-0.01	0.62	-0.04	0.03	-0.02	0.50	-0.05	0.03	-0.05	0.29
RT × Gov. Debt												
Gov. Debt												
FX CRISIS (*)	0.71	0.00	2.22	0.28	0.72	0.00	2.25	0.26	0.74	0.00	1.83	0.46
Volat. Benchmark Currency									0.16	0.01	0.14	0.13
Exc. Rate Regime: FIX (*)	-0.12	0.00	-0.13	0.00	-0.12	0.00	-0.12	0.00	-0.05	0.18	-0.05	0.30
Exc. Rate Regime: Dirty FLOAT (*	-0.01	0.77	-0.02	0.60	-0.01	0.84	-0.01	0.68	0.08	0.02	0.10	0.04
Exc. Rate Regime: FLOAT									0.18	0.00	0.19	0.00
POLRISK (*)									0.00	0.67	0.00	0.77
FINRISK									-0.01	0.11	0.00	0.50
TRADEOPEN (*)	-0.04	0.62	-0.04	0.64	-0.04	0.38	-0.03	0.59	0.01	0.89	0.05	0.65
FINOPEN									-0.01	0.48	-0.02	0.51
FINDEPTH									0.00	0.33	0.00	0.75
OUTPUT GAP									1.85	0.02	0.81	0.65
INT. RATE DIFFERENTIAL												
GDP GROWTH (*)	0.00	0.99	0.00	0.91	0.00	0.58	0.00	0.51	-0.01	0.27	-0.01	0.19
INFLATION (*)	-0.04	0.28	-0.02	0.48	-0.04	0.32	-0.02	0.55	-0.01	0.79	-0.02	0.59
Volatility of Money Growth (*)	0.02	0.31	0.00	0.87	0.02	0.24	0.01	0.82	0.02	0.23	0.02	0.57
(CA/GDP) (*)	-0.01	0.02	-0.01	0.02	-0.01	0.00	-0.01	0.00	-0.01	0.01	-0.01	0.01
Δ (GOV. BAL./GDP) (*)	0.00	0.11	0.00	0.11	0.00	0.11	0.00	0.11	0.00	0.78	0.00	0.27
D(FFR)												
FFR_SUPRISE												
LOG(VIX)												
LOG(SD_OIL)												
LOG(SD_WGRWTH)												
@TREND	0.00	0.36	-0.08	0.29	0.00	0.37	-0.02	0.16	0.00	0.91	-0.04	0.06
AR(1)												
Periods	90		90		90		90		84		83	
Cross-sections	68		68		70		70		63		63	
Observations	3894		3875		3943		3923		3263		3198	
Adj. R^2	0.82		0.81		0.82		0.82		0.80		0.76	
Normality: # of countries	39		33		44		37		40		35	
Average Marginal Effect	effect	*prob.*	effect	*prob.*	effect	*prob.*	effect	*prob.*	effect	*prob.*	effect	*prob.*
At the median	-1.5%	0.68	-1.3%	0.73	-2.5%	0.49	-2.0%	0.59	0.2%	0.96	-0.01	0.79
At the mean	-2.5%	0.50	-1.7%	0.64	-3.6%	0.32	-2.7%	0.47	-1.3%	0.75	-0.03	0.54

Model	Extended set of control variables: No Interactions — OLS Coef.	OLS *prob.*	GMM Coef.	GMM *prob.*	Gov. Debt, alternative RA — OLS Coef.	OLS *prob.*	GMM Coef.	GMM *prob.*	Global Factors — OLS Coef.	OLS *prob.*	GMM Coef.	GMM *prob.*
C	-1.91	0.00	11.36	0.06	-2.57	0.00	6.70	0.23	-3.07	0.00	-3.17	0.00
Reserves Template, *RT* (*)	0.01	0.79	0.00	0.95	-0.17	0.02	-0.19	0.06	-0.09	0.18	-0.12	0.24
RT × *D* (*)												
RT × *RA* (*)					0.04	0.01	0.04	0.05	0.03	0.08	0.03	0.15
Indebtedness, *D* (*)	0.00	0.46	0.00	0.72								
Reserve adequacy, *RA* (*)	-0.01	0.42	-0.01	0.81	-0.02	0.31	-0.01	0.64	-0.03	0.11	-0.03	0.36
RT × Gov. Debt					0.00	0.87	0.00	0.97	0.01	0.02	0.02	0.03
Gov. Debt					0.00	0.51	0.00	0.96	0.00	0.53	0.00	0.79
FX CRISIS (*)	0.75	0.00	1.85	0.45	0.60	0.00	1.45	0.36	0.82	0.00	3.17	0.21
Volat. Benchmark Currency	0.16	0.01	0.13	0.13	0.13	0.02	0.09	0.19	0.19	0.00	0.11	0.32
Exc. Rate Regime: FIX (*)	-0.07	0.08	-0.06	0.15	-0.03	0.40	-0.03	0.46	-0.05	0.20	-0.03	0.57
Exc. Rate Regime: Dirty FLOAT (*	0.07	0.03	0.09	0.05	0.09	0.01	0.09	0.02	0.10	0.01	0.11	0.01
Exc. Rate Regime: FLOAT	0.18	0.00	0.20	0.00	0.17	0.00	0.17	0.00	0.17	0.00	0.17	0.00
POLRISK (*)	0.00	0.65	0.00	0.73	0.00	0.52	0.00	0.40	0.00	0.52	0.00	0.86
FINRISK	0.00	0.21	0.00	0.73	-0.01	0.01	-0.01	0.13	-0.01	0.07	-0.01	0.02
TRADEOPEN (*)	0.00	0.97	0.04	0.70	0.11	0.19	0.03	0.79	-0.02	0.73	-0.01	0.92
FINOPEN	0.00	0.87	0.00	0.89	-0.02	0.27	-0.02	0.42	-0.01	0.67	-0.02	0.47
FINDEPTH	0.00	0.58	0.00	0.94	0.00	0.08	0.00	0.06	0.00	0.39	0.00	0.96
OUTPUT GAP	1.81	0.02	0.70	0.70	1.08	0.14	1.53	0.33	1.07	0.12	-0.50	0.69
INT. RATE DIFFERENTIAL					0.01	0.03	0.00	0.73				
GDP GROWTH (*)	0.00	0.38	-0.01	0.30	0.00	0.79	0.00	0.76	0.01	0.02	0.02	0.02
INFLATION (*)	-0.02	0.61	-0.03	0.45	0.01	0.96	0.48	0.33	0.62	0.01	0.30	0.40
Volatility of Money Growth (*)	0.02	0.31	0.01	0.68	0.02	0.34	0.02	0.48	0.00	0.90	0.02	0.56
(CA/GDP) (*)	-0.01	0.01	-0.01	0.00	0.00	0.11	0.00	0.39	-0.01	0.00	-0.01	0.00
Δ (GOV. BAL./GDP) (*)	0.00	0.74	0.00	0.26	0.00	0.25	0.00	0.89	0.00	0.55	0.00	0.01
D(FFR)									0.00	0.97	0.05	0.15
FFR_SUPRISE									0.29	0.27	-0.19	0.61
LOG(VIX)									0.17	0.00	0.06	0.46
LOG(SD_OIL)									0.07	0.05	-0.06	0.51
LOG(SD_WGRWTH)									0.00	0.70	0.03	0.16
@TREND	0.00	0.80	-0.16	0.02	0.00	0.64	-0.10	0.10	0.00	0.01	0.00	0.02
AR(1)												
Periods	84		83		84		83		76		76	
Cross-sections	63		63		59		59		63		63	
Observations	3236		3198		2837		2795		2905		2869	
Adj. R^2	0.80		0.76		0.83		0.83		0.82		0.75	
Normality: # of countries	41		31		43		39		45		34	
Average Marginal Effect	effect	*prob.*	effect	*prob.*	effect	*prob.*	effect	*prob.*	effect	*prob.*	effect	*prob.*
At the median	1.1%	0.79	-0.3%	0.95	-2.2%	0.56	-3.0%	0.45	0.9%	0.79	0.9%	0.83
At the mean	1.1%	0.79	-0.3%	0.95	-3.9%	0.32	-4.7%	0.26	-0.5%	0.90	-1.0%	0.81

Model	Parsimonious model (search routine with 10% significance): Full Sample — OLS Coef.	OLS *prob.*	GMM Coef.	GMM *prob.*	Advanced Economies — OLS Coef.	OLS *prob.*	GMM Coef.	GMM *prob.*	Emerging Economies — OLS Coef.	OLS *prob.*	GMM Coef.	GMM *prob.*
C	-2.49	0.00	10.28	0.03	-2.25	0.00	-2.86	0.00	-3.37	0.74	-0.92	0.52
Reserves Template, *RT* (*)	-0.13	0.01	-0.14	0.01	-0.09	0.04	-0.10	0.02	0.02	0.74		
RT × *D* (*)												
RT × *RA* (*)	0.03	0.00	0.04	0.00	0.03	0.00	0.04	0.00				
Indebtedness, *D* (*)												
Reserve adequacy, *RA* (*)												
RT × Gov. Debt									-0.01	0.06		
Gov. Debt									0.01	0.01		
FX CRISIS (*)	0.70	0.00			0.82	0.00					8.51	0.03
Volat. Benchmark Currency	0.17	0.00	0.19	0.00	0.20	0.00	0.22	0.00				
Exc. Rate Regime: FIX (*)									-0.15	0.01	-0.14	0.01
Exc. Rate Regime: Dirty FLOAT (*	0.07	0.01	0.09	0.00								
Exc. Rate Regime: FLOAT	0.19	0.00	0.18	0.00	0.11	0.00	0.12	0.00	0.15	0.00		
POLRISK (*)												
FINRISK	-0.01	0.01	-0.01	0.00	-0.01	0.00	-0.02	0.00	-0.01	0.04		
TRADEOPEN (*)												
FINOPEN					-0.04	0.02	-0.05	0.01				
FINDEPTH	0.00	0.06	0.00	0.07	0.00	0.01	0.00	0.01				
OUTPUT GAP	1.48	0.01	2.06	0.00	1.74	0.00	2.24	0.00				
INT. RATE DIFFERENTIAL	0.00	0.00					-0.02	0.00	0.01	0.00		
GDP GROWTH (*)												
INFLATION (*)							1.53	0.02				
Volatility of Money Growth (*)					0.03	0.01	0.06	0.00				
(CA/GDP) (*)	-0.01	0.03	-0.01	0.00								
Δ (GOV. BAL./GDP) (*)					0.00	0.08						
D(FFR)												
FFR_SUPRISE												
LOG(VIX)												
LOG(SD_OIL)												
LOG(SD_WGRWTH)												
@TREND	0.00	0.04	-0.14	0.01	0.00	0.00	0.01	0.00	0.01	0.93	-0.02	0.18
AR(1)												
Periods	85		84		87		87		95		95	
Cross-sections	67		69		25		25		42		49	
Observations	3430		3533		1624		1615		2339		3205	
Adj. R^2	0.81		0.80		0.89		0.89		0.86		0.79	
Normality: # of countries	46		41		21		19		25		15	
Average Marginal Effect	effect	*prob.*	effect	*prob.*	effect	*prob.*	effect	*prob.*	effect	*prob.*	effect	*prob.*
At the median	-1.3%	0.68	-1.2%	0.74	-2.4%	0.49	-1.4%	0.69	2.1%	0.72	n.a	n.a
At the mean	-2.8%	0.39	-2.6%	0.45	-2.2%	0.53	-1.1%	0.75	2.2%	0.69	n.a	n.a

Source: Authors' calculations.
Note: (*) indicates that the same or similar series were used in CGG (2007); *p*-values computed using robust standard errors (cross-section clustering).

69. These results cast doubt on the conclusions reported in CGG (2007). On the one hand, they show the lack of robustness of the estimates across different specifications of equation (3). On the other hand, they are broadly in line with our interpretation of those in CGG (2007): the interaction terms seem to help the estimated coefficient of RT become negative and significant, but they are not enough to make the *total* effect of RT on exchange rate volatility negative and significant when considering the mean and/or the median levels of indebtedness and reserve adequacy.

70. Table 11, constructed based on the estimations of the parsimonious model using the full sample reported in Table 10, shows that the total effect of the Reserves Template is not significant across different values of reserve adequacy, except for cases of low levels of reserve adequacy (first quartile of the distribution).

Table 11. Effect of RT on Exchange Rate Volatility at Different Values of *RA*

RT-Related Estimated Coefficients		OLS	GMM	Total Effects	OLS	GMM
Reserves Template(RT_{it})	$= \lambda_1$	-0.13	-0.14	Mean RA_{it}	3.17	3.20
		(0.01)	(0.01)	Marginal effect of RT at mean RA [1]	-2.8%	-2.6%
					(0.39)	(0.45)
RT_{it} × Debt/GDP ratio (D_{it})	$= \lambda_2$	n.a	n.a			
					OLS	GMM
RT_{it} × Reserve Adequacy (RA_{it})	$= \lambda_3$	0.03	0.04	Median RA_{it}	3.60	3.62
		(0.00)	(0.00)	Marginal effect of RT at median RA	-1.3%	-1.2%
					(0.68)	(0.74)

Marginal Effects at different values of RA_{it} (or D_{it}, for EMEs)

	Full Sample		AE subsample		EME subsample	
	OLS	GMM	OLS	GMM	OLS	GMM
First Quartile	-7.4%	-7.5%	-5.8%	-5.7%	3.8%	0.0%
	(0.04)	(0.05)	(0.13)	(0.12)	(0.51)	n.a
Median	-1.3%	-1.2%	-2.4%	-1.4%	-5.8%	0.0%
	(0.68)	(0.74)	(0.49)	(0.69)	(0.72)	n.a
Third Quartile	1.8%	2.2%	2.5%	5.0%	-5.8%	0.0%
	(0.60)	(0.56)	(0.48)	(0.21)	(0.94)	n.a
Mean	-2.8%	-2.6%	-2.2%	-1.1%	-5.8%	0.0%
	(0.39)	(0.45)	(0.53)	(0.75)	(0.69)	n.a

Source: Authors' calculations.

Notes: (1) Marginal effects at the mean and median are calculated as $\left(e^{\lambda_1+\lambda_2\bar{D}_{it}+\lambda_3\overline{RA}_{it}}-1\right)$ x 100, where $\bar{X}$ indicates the mean or median of X. The associated *p*-values (in parenthesis) refer to Wald tests and are computed using the delta method.

E. Summary

71. The original results reported in CGG (2007) survive the placebo tests: "false positives" typically do not occur—i.e., the effect of the SDDS on exchange rate volatility is not observed before the date when a country actually began subscribing to the SDDS—and, when they do occur, they are concentrated around the actual SDDS dates. However, the results are not robust to (i) the addition of more countries in the control group; (ii) a correction made to two series—critical for the original results—that are erroneously constructed; (iii) the removal of interaction terms with these two variables; or (iv) the use of alternative ways to control for global factors.

72. More importantly, when considering the total effect of the RT—rather than just its direct effect—the results reported in CGG (2007) do not support the conclusion that the adoption of the RT helps reduce exchange rate volatility. The interaction of both indebtedness and reserve adequacy with the RT indicator introduced in CGG's model help generate a negative and statistically significant coefficient for RT, but this coefficient only reflects the direct effect of RT. The indirect effects of such interaction terms were not taken into account by CGG when measuring the total RT effect.

73. Using their dataset and estimation results, we find that the total effect of RT on exchange rate volatility, when properly measured, is not statistically significant. Consistently, when we use CGG's data and model *without* interaction terms, the direct effect (which then becomes the total effect) of RT on exchange rate volatility is also not statistically significant.

74. Finally, when we estimate the CGG model over an extended sample period, adding more countries and using alternative sets of regressors, we confirm the results from the robustness checks on the original dataset and model. With the interaction terms in the regressions, we find: (i) a negative and significant coefficient for the direct effect of RT on exchange rate volatility in some specifications, in line with CGG (2007), but not in all specifications; and (ii) no statistically significant (total) effect of RT on exchange rate volatility. Without interactions, the coefficient of the RT dummy is again found to be not statistically significant.

75. Taken together, the results reported in this section do not provide support for the conclusion in CGG (2007) that adoption of the RT reduces a country's exchange rate volatility.

V. IMF Data Initiatives and Sovereign Bond Spreads

76. This section studies the effects of GDDS and SDDS on sovereign bond yields and spreads. Cady and Pellechio (2006), henceforth CP, report that subscription to the SDDS and GDDS reduces launch spreads on the sovereign bonds of 26 emerging market economies by an average of 20 percent and 8 percent, respectively.

A. Cady and Pellechio (2006)

77. Using data on 320 new issues of sovereign bonds denominated in U.S. dollars, Japanese yen, and euros from 26 emerging market and developing countries that had access to private capital markets between 1989 and 2004, CP (2006) estimate a log-linear panel regression of sovereign bond "costs" on a set of control variables that reflect both bond and country characteristics and dummy variables for participation in GDDS and SDDS. The estimated model in CP (2006) is:

$$C_{it} = \beta + \alpha_i + \mu\, Time + \lambda_1 GDDS_{it} + \lambda_2 SDDS_{it} + \theta\Psi_{it} + \varepsilon_{it}, \quad (4)$$

where C_{it} is either the (log) spread or yield, measured *at launch*, of sovereign bonds issued by country i in year t; β is a constant, α_i is a country-specific fixed effect, and $Time$ is a linear time trend; $GDDS_{it}$ and $SDDS_{it}$ are dummy variables that take the value of one if country i is a subscriber of GDDS and SDDS at year t, respectively; Ψ_{it} is a vector of control variables, and ε_{it} is an error term.

78. The vector Ψ_{it} includes macroeconomic fundamentals—the quarterly rate of real GDP growth, inflation differentials vis-à-vis the United States, primary fiscal balance, external debt-to-export ratio, an indicator of participation in IMF programs, and the ICRG index of country institutional quality. It also includes bond maturity, the yield of the benchmark risk-free bond, and dummy variables for the currency of denomination—euro and yen; the U.S. dollar is used as reference.[44]

79. The estimated effects of the GDDS and SDDS are captured by parameters λ_1 and λ_2. Their estimated values suggest that the SDDS reduces launch spreads by an average of 20 percent, while participation in the GDDS reduces spreads by an average of 8 percent.

B. Data Issues

80. We have two concerns regarding the dataset used in CP (2006). First is the use of country-quarter observations that should actually be treated as missing: bonds are not issued in every quarter, which implies missing values of the dependent variable (either yields or spreads). These missing observations are nevertheless included in the CP sample, replaced by yields or spreads from the last observed bond issuance. Potentially, data from several quarters in the past can be used to represent the dependent variable at any given quarter, introducing both artificial persistency in the data and, possibly, bias (if spreads and yields trend up or down, say in response to global or domestic conditions between bond issuances).

[44] The authors use the Bonds, Equities, and Loans (BEL) database for the series of spreads, yields, maturity, and currency of denomination of sovereign bonds. See CP (2006), pp. 20–21 and Annex 1.

81. Second, in any quarter there may be more than one bond issuance, with different yields and/or spreads.[45] CP (2006) only uses data from the first issuance, leaving out information on all other issuances during the same quarter. In our estimations of alternative versions of equation (4), we structure the panel data in a way that circumvents both these concerns.

C. Robustness Checks

82. As in the previous section, we present two types of robustness checks on the results reported in CP (2006): (i) placebo tests whereby the actual GDDS and SDDS dates are replaced by false dates; and (ii) estimations of equation (4) over different samples, using different control variables.

Placebo tests

83. Table 12 displays the results of placebo tests on CP's estimation of equation (4) using spreads.[46] For both the deterministic and random changes in SDDS/GDDS dates, three cases are discussed: (i) only GDDS dates are changed, (ii) only SDDS dates are changed, and (iii) both SDDS and GDDS dates are changed. In what follows, let t_0 be the date when country *i* receives "treatment" (i.e., subscribes to the GDDS or SDDS). Taken together, the results in Table 12 suggest that the results in CP (2006) are robust to placebo tests—i.e., estimates of the GDDS or SDDS effects do not hold unless treatment is received. The GDSS and SDDS dummies tend to affect spreads only at t_0 or after, while false positives are rare and, when they occur, tend to be concentrated within two to four quarters from t_0.[47]

84. For instance, when only false GDDS dates are used, the original results (at t_0) do not hold: the estimated coefficient associated with the GDDS (λ_1) is either not statistically significant or is positive, while the SDDS coefficient (λ_2) is always significant and very similar to the original estimate. Moreover, the frequency of statistically significant estimates of λ_1 in random placebos is no higher than 40 percent, while that of estimates of λ_2 is at 99 percent.

85. Results in CP (2006) are also robust when only false SDDS dates are considered, although here the evidence is less strong. The estimated GDDS coefficient is always significant and close in value to the original estimate (especially when the SDDS dates are

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[45] Possible reasons are: inflation-indexed versus non-indexed bonds, floating versus fixed rates, different maturities, or bonds issued in different currencies.

[46] The results of placebo tests on the yields equation—available from the authors upon request—are broadly similar.

[47] This may indicate that the effects of data initiatives could start at some time prior to the actual subscription, as countries prepare themselves to meet the SDDS requirements.

moved only a few quarters before or after t_0). But the SDDS coefficients are typically not significant when the SDDS dates are moved backwards by more than four quarters from t_0. They tend to be significant only when the false SDDS dates are within two quarters before and three quarters after t_0. This is not necessarily a reason for concern.[48] However, in random placebo tests, while the frequency of statistically significant estimates of λ_1 is very high, that of λ_2 is also high—above 60 percent, in some cases, even considering intervals larger than six months around t_0. This casts some doubt on the robustness of the original results.

86. Finally, the results are also somewhat robust to moving both GDDS and SDDS dates to counterfactual, false dates: (i) negative and significant coefficients typically are only observed after the actual subscription dates; (ii) the frequency of significant results is typically low (less than 50 percent) in random placebos; and (iii) false positives are concentrated around two quarters of t_0.

Different control variables and sample

87. One concern regarding the econometric model in CP (2006) is that it does not control for the effects of common factors on the spreads and yields of all countries. Equation (4) uses neither period fixed effects nor global control variables, but only a time trend, which may be too blunt to account for those factors.

88. Table 13 shows the robustness of the original CP (2006) estimates to (i) controlling for global factors that could potentially affect bond issuances from all countries in the sample—using either period fixed effects or selected measures of global liquidity and risk conditions (VIX, unanticipated shocks in the U.S. monetary policy rate, and global capital flows as a percentage of global GDP); (ii) the removal of missing observations in quarters without bond issuances; (iii) different subsamples according to the currency of bond denomination (U.S. dollar, euro, or yen); and (iv) updated samples, including additional countries or more recent periods.[49] For convenience, the original results are shown in column 2. All results, except for the robustness tests to (iv), in columns 9–10, are obtained using the original dataset in CP (2006).

89. The results for the effects of GDDS and SDDS are somewhat robust to the alternative estimations in Table 13, but not always. For instance, the results from CP (2006) hold when equation (4) is estimated using global control variables and the original dataset (column 4), or when updated data are used while keeping the same countries as in the original sample (column 9). However, the results are not robust to the remaining alternative setups.

[48] See previous footnote.

[49] The CP original sample covered the period 1991Q1–2004Q4. We extended it until the end of 2013.

Table 12. Placebo Tests: Sensitivity of CP's Results to False GDDS and SDDS Dates

Only GDDS Date Changes

Deterministic Date Changes

GDDS dummy moved to	GDDS dummy λ_1	GDDS dummy *p*-value	SDDS dummy λ_2	SDDS dummy *p*-value
t_0-10	0.16	0.00	-0.14	0.00
t_0-9	0.02	0.50	-0.17	0.00
t_0-8	-0.03	0.39	-0.17	0.00
t_0-7	0.07	0.02	-0.16	0.00
t_0-6	0.01	0.81	-0.17	0.00
t_0-5	0.04	0.24	-0.17	0.00
t_0-4	-0.01	0.62	-0.17	0.00
t_0-3	0.05	0.13	-0.16	0.00
t_0-2	0.10	0.00	-0.16	0.00
t_0-1	0.06	0.05	-0.17	0.00
t_0	-0.10	0.00	-0.19	0.00
t_0+1	-0.04	0.27	-0.17	0.00
t_0+2	0.00	0.99	-0.17	0.00
t_0+3	-0.06	0.11	-0.17	0.00
t_0+4	-0.06	0.14	-0.18	0.00
t_0+5	-0.06	0.10	-0.17	0.00

Random Date Changes

Number of Statistically Significant Results at the 5% and 10% levels per 100 Estimations of CP's Equation (4)

GDDS dummy coefficient

Time Interval	year t_0 included 5%	year t_0 included 10%	λ_1 Average		year t_0 excluded 5%	year t_0 excluded 10%	λ_1 Average
t_0-10 , t_0+5	23	30	0.02	0	35	39	0.03
t_0-5 , t_0+5	17	25	0.00	0	17	23	0.02
t_0-2 , t_0+2	24	31	0.00	0	18	27	0.03
t_0-5 , t_0-1	33	37	0.05	0	33	40	0.05

SDDS dummy coefficient

Time Interval	year t_0 included 5%	year t_0 included 10%	λ_2 Average		year t_0 excluded 5%	year t_0 excluded 10%	λ_2 Average
t_0-10 , t_0+5	99	99	-0.17	0	99	99	-0.17
t_0-5 , t_0+5	99	99	-0.17	0	99	99	-0.17
t_0-2 , t_0+2	99	99	-0.17	0	99	99	-0.17
t_0-5 , t_0-1	99	99	-0.17	0	99	99	-0.17

Only SDDS Date Changes

Deterministic Date Changes

SDDS dummy moved to	GDDS dummy λ_1	GDDS dummy *p*-value	SDDS dummy λ_2	SDDS dummy *p*-value
t_0-10	-0.06	0.06	0.01	0.85
t_0-9	-0.06	0.05	-0.04	0.22
t_0-8	-0.06	0.06	-0.02	0.58
t_0-7	-0.06	0.08	0.07	0.07
t_0-6	-0.06	0.05	-0.04	0.21
t_0-5	-0.07	0.04	-0.04	0.31
t_0-4	-0.08	0.02	-0.15	0.00
t_0-3	-0.05	0.10	0.13	0.00
t_0-2	-0.07	0.04	-0.07	0.06
t_0-1	-0.07	0.04	-0.08	0.04
t_0	-0.10	0.00	-0.19	0.00
t_0+1	-0.09	0.01	-0.21	0.00
t_0+2	-0.07	0.03	-0.09	0.02
t_0+3	-0.07	0.02	-0.14	0.00
t_0+4	-0.06	0.08	0.07	0.08
t_0+5	-0.07	0.05	-0.02	0.52

Random Date Changes

Number of Statistically Significant Results at the 5% and 10% levels per 100 Estimations of CP's Equation (4)

GDDS dummy coefficient

Time Interval	year t_0 included 5%	year t_0 included 10%	λ_1 Average		year t_0 excluded 5%	year t_0 excluded 10%	λ_1 Average
t_0-10 , t_0+5	64	98	-0.07	0	59	99	-0.07
t_0-5 , t_0+5	64	97	-0.07	0	66	98	-0.07
t_0-2 , t_0+2	97	99	-0.08	0	91	99	-0.07
t_0-5 , t_0-1	59	94	-0.07	0	57	95	-0.07

SDDS dummy coefficient

Time Interval	year t_0 included 5%	year t_0 included 10%	λ_2 Average		year t_0 excluded 5%	year t_0 excluded 10%	λ_2 Average
t_0-10 , t_0+5	44	53	-0.05	0	33	43	-0.04
t_0-5 , t_0+5	51	61	-0.06	0	51	60	-0.07
t_0-2 , t_0+2	82	88	-0.11	0	76	81	-0.11
t_0-5 , t_0-1	50	62	-0.04	0	52	60	-0.04

Changes to both GDDS and SDDS Dates

Deterministic Date Changes

SDDS dummy moved to	GDDS dummy λ_1	GDDS dummy *p*-value	SDDS dummy λ_2	SDDS dummy *p*-value
t_0-10	0.19	0.00	0.04	0.29
t_0-9	0.03	0.29	-0.04	0.30
t_0-8	-0.01	0.65	-0.02	0.58
t_0-7	0.11	0.00	0.08	0.02
t_0-6	0.02	0.52	-0.04	0.31
t_0-5	0.05	0.09	-0.02	0.52
t_0-4	-0.02	0.55	-0.15	0.00
t_0-3	0.11	0.00	0.15	0.00
t_0-2	0.11	0.00	-0.05	0.14
t_0-1	0.06	0.06	-0.06	0.11
t_0	-0.10	0.00	-0.19	0.00
t_0+1	-0.07	0.04	-0.22	0.00
t_0+2	-0.01	0.84	-0.08	0.02
t_0+3	-0.07	0.05	-0.15	0.00
t_0+4	-0.02	0.67	0.07	0.07
t_0+5	-0.05	0.19	-0.02	0.56

Random Date Changes

Number of Statistically Significant Results at the 5% and 10% levels per 100 Estimations of CP's Equation (4)

GDDS dummy coefficient

Time Interval	year t_0 included 5%	year t_0 included 10%	λ_1 Average		year t_0 excluded 5%	year t_0 excluded 10%	λ_1 Average
t_0-10 , t_0+5	27	35	0.04	0	42	48	0.04
t_0-5 , t_0+5	16	23	0.01	0	23	26	0.03
t_0-2 , t_0+2	25	31	0.01	0	21	27	0.03
t_0-5 , t_0-1	42	50	0.06	0	41	48	0.06

SDDS dummy coefficient

Time Interval	year t_0 included 5%	year t_0 included 10%	λ_2 Average		year t_0 excluded 5%	year t_0 excluded 10%	λ_2 Average
t_0-10 , t_0+5	42	52	-0.05	0	30	36	-0.03
t_0-5 , t_0+5	45	59	-0.06	0	49	58	-0.06
t_0-2 , t_0+2	76	84	-0.11	0	74	78	-0.10
t_0-5 , t_0-1	47	58	-0.03	0	49	58	-0.03

Source: Authors' calculations using data from CP (2006).

Table 13. Robustness to Alternative Set of Control Variables and Sample

Variable	Original CP (2006) Data							Updated Data	
	CP(2006) original results	Period fixed effects	Global control variables	No missing observations	US$ bonds only	€ bonds only	¥ bonds only	Same countries	Additional countries
Spreads									
GDDS, λ_1	-0.09	-0.09	-0.09	0.56	-0.15	0.06	n.a.	-0.09	-0.03
	(0.00)	(0.06)	(0.01)	(0.00)	(0.00)	(0.59)	n.a.	(0.01)	(0.12)
SDDS, λ_2	-0.19	-0.05	-0.19	-0.07	-0.04	-2.05	-3.42	-0.19	-0.01
	(0.00)	(0.29)	(0.00)	(0.28)	(0.40)	(0.01)	(0.36)	(0.00)	(0.29)
Yields									
GDDS, λ_1	-0.03	-0.02	-0.04	0.17	-0.06	0.09		-0.04	-0.02
	(0.00)	(0.43)	(0.01)	(0.02)	(0.00)	(0.01)		(0.01)	(0.01)
SDDS, λ_2	-0.09	-0.01	-0.11	-0.09	-0.02	-0.42	-1.25	-0.11	-0.04
	(0.00)	(0.76)	(0.00)	(0.01)	(0.17)	(0.51)	(0.50)	(0.00)	(0.00)

Source: Authors' calculations using data from CP (2006), *WEO*, and *IFS*.

D. Do IMF Data Dissemination Initiatives Help Reduce Sovereign Borrowing Costs?

90. Using an updated sample of quarterly data from 90 countries over 1991Q1–2013Q4, substantially larger than that used in CP (2006), we estimate the following panel equation:

$$C_{its} = \beta + \alpha_{is} + \mu_t + \lambda_1 GDDS_{its} + \lambda_2 SDDS_{its} + \gamma X_{its} + \theta \Psi_{its} + \varepsilon_{its}, \tag{5}$$

where C_{its} is the spread or yield (in logs) of a bond issued in currency s (U.S. dollar, euro, or yen), at time t, by country i; β is a constant, α_{is} and μ_t are country-currency and period fixed effects, respectively; $GDDS_{its}$ and $SDDS_{its}$ are the dummy variables for subscription to IMF data initiatives; X_{its} is a vector of bond characteristics; Ψ_{its} is a vector of domestic control variables, and ε_{it} is an error term. In alternative specifications of (5), period fixed effects are replaced by a linear time trend and a vector of global control variables.[50]

91. Equation (5) differs from CP's original equation (4) in four important respects. First, in the panel structure, we split the country cross-sections into three groups—to accommodate bond issues in U.S. dollars, euros, and yen. This allows us to use the average yield or spread (weighted by the nominal value) of bond issues in each currency of denomination within a quarter—rather than just the first observation, as in CP (2006). Second, we treat observations

[50] The vector of global control variables includes: total and unanticipated changes in U.S. monetary policy rates, the VIX index of market volatility, and the standard deviations (within a quarter) of oil prices and world real GDP growth.

from periods with no bond issuance in currency s as missing and exclude them from the sample. These two changes mitigate our concerns discussed in subsection V.B.

92. Third, we control for common factors using period fixed effects (or global variables). Lastly, in addition to the domestic control variables used in CP (2006), we include in Ψ_{it}: ICRG measures of political[51] and financial risk; measures of financial openness (FINOPEN) and financial market depth (FINDEPTH);[52] one measure of the business cycle (OUTPUT GAP); both the relative size and productivity level (proxy by GDP and per capita GDP, respectively) vis-à-vis the United States; the standard deviation of inflation; and the five-year-ahead *WEO* forecast of real GDP growth.[53]

93. The estimation results for different specifications of equation (5) for spreads and yields are displayed in Table 14(a)–(b). As in the previous sections, we present alternative versions of the model using: (i) restricted sets of regressors (columns 2–5 and 6–9); (ii) the full set of regressors—using either period fixed effects (columns 10–13), global variables and a time trend (columns 14–17), or currency-country fixed effects (columns 18–21); and (iii) a parsimonious model—resulting from a search routine that successively eliminates variables not statistically significant at the 10 percent level—estimated on the full sample using either period fixed effects (columns 22–25) or global variables (columns 26–29) to control for common factors working across countries.

94. In what follows, we refer to results in Tables 14(a)–(b). First, note that neither the SDDS nor the GDDS coefficient is negative and statistically significant across different specifications of (5) for spreads. The same is true for yields, except that a *positive* estimated coefficient of the GDDS dummy is obtained using the most restricted specification. Thus, after updating the sample and addressing the data-related concerns discussed above (subsection V.B), we cannot confirm the results in CP (2006): we fail to find evidence that IMF data standards initiatives help to reduce sovereign borrowing costs.

95. Second, as in previous sections, our OLS and GMM estimations are broadly consistent with each other—which mitigates concerns about endogeneity. Normality tests on the residuals do not seem to indicate any problem. Third, the estimated coefficients on the remaining variables, when significant, typically have the expected sign. In particular:

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[51] The index of political risk incorporates an index of institutional quality in line with that used in CP (2006).

[52] As in the previous section, we repeat the values of series only available at annual frequency in all quarters within the year. See Annex 1.

[53] For a description of the data and sources, see Annex 1.

- Yields and spreads in bonds denominated in U.S. dollars seem higher on average than those of yen-denominated bonds. The same is true for yields (but not spreads) of euro-denominated bonds.

- Longer maturities and higher benchmark interest rates are positively associated with higher yields, but typically do not translate into higher spreads.

- Lower degrees of political and financial risk[54] and deeper financial markets are associated with lower yields. Political and financial risks are also positively correlated with spreads. Financial openness is associated with higher spreads (but not yields), but only in some specifications.[55]

- Bonds issued during economic booms—when the level of real GDP is above its HP-trend—tend to be associated with lower spreads and yields. Expected future growth is also negatively correlated with sovereign borrowing costs in some, but not all, specifications.[56] The inflation differential is typically not significant and seems irrelevant.

- Richer and smaller economies—as defined by higher per capita and total GDP relative to that of the U.S., respectively—seem to issue bonds with higher yields (but not higher spreads).[57]

- The debt-to-export ratio and inflation volatility—both of which indicate higher levels of domestic risk factors—also tend to lead to higher spreads and yields. On the other hand, there is some (weak) evidence that government balances help to reduce sovereign borrowing costs.

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[54] A decrease in POLRISK and FINRISK indicates higher risk.

[55] Reis (2013) discusses how financial openness combined with limited depth in financial markets can have destabilizing effects on the macro economy through the misallocation of capital inflows which lead to reallocation of resources from the tradable to the nontradable sector. Mendoza (2006) describes how this process may create the conditions for a future sudden stop.

[56] Actual growth, on the other hand, seems to be associated with higher borrowing costs, especially spreads, but the evidence is weak for spreads and very weak for yields. In both cases, this effect does not typically survive the search routine, and it does not seem to come from emerging-market economies. One possible explanation why expected growth reduces borrowing costs and actual growth increases them is that what really matters is the expected *acceleration* of growth.

[57] Given the high correlation between these two variables, and the similar absolute value of their estimated coefficients, which have opposite signs, the net effect of these two variables is close to zero as confirmed by Wald tests. When the search routine is used—see results in columns 26–29 of Tables 14(a)–(b)—only the negative effect of size on yields remains significant.

- During IMF programs, when countries are likely experiencing financial or economic distress, borrowing costs are higher, especially spreads.

- In the specifications that rely on global variables to control for common factors across countries, monetary policy tightening in the U.S., especially if unanticipated, is associated with higher spreads but not higher yields.

- Increases in the volatility of markets (VIX) and of oil prices correlate with higher borrowing costs. That is not the case for the volatility of world GDP.

96. All these considerations are robust to estimations restricted to a subsample of emerging-market economies, as in the original paper by CP (2006).[58]

E. Summary

97. The results reported in this section do not support the hypothesis that the SDDS and GDDS initiatives help to reduce sovereign borrowing costs. Although the original results reported in CP (2006) are largely robust to placebo tests—false positives before subscription are rare and/or tend to occur within two quarters of the true subscription dates—they are not robust to (i) the introduction of period fixed effects to control for common factors affecting all countries; (ii) changes in the treatment of missing observations needed to remove distortions in the data on yields and spreads (see subsection V.B); or (iii) estimations of a modified version of the original model that features a different set of explanatory variables and a larger and updated panel data sample (both more recent periods and additional countries).

VI. Event Studies

98. This section discusses the results of "event studies" used as an alternative approach to identify the effect of participation in IMF data standards on (gross) FDI flows, exchange rate volatility, and sovereign borrowing costs. The econometric strategies discussed in the previous three sections rely on the implicit assumption that a country's decision to subscribe to IMF data standards is strictly exogenous, independent of any attribute or characteristic of that country. But if the decision is not orthogonal to a set of characteristics of the subscribing country—including the state of the country's economy—a selection bias may invalidate any attempt at statistical inference on the estimated effect of data standards on the variables of interest. That effect, under these circumstances, can be overstated.

[58] Results are available from the authors upon request.

Table 14(a). Estimation Results—Spreads

Model	Country Fixed Effects																Currency-Country Fixed Effects				Parsimonious Model							
	Period Fixed Effects												Global Control Variables				Period Fixed effects				(search routine with 10% significance)							
	Restricted Model				Policy and Bond Features				Full Set of Variables				Full Set of Variables				Full Set of Variables				Period Fixed Effects				Global Control Variables			
	OLS		GMM		OLS		GMM		OLS		GMM		OLS		GMM		OLS		GMM		OLS		GMM		OLS		GMM	
Variable	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*
C	5.93	0.00	5.93	0.00	9.15	0.00	9.15	0.00	2.77	0.28	-1.31	0.59	3.57	0.24	4.33	0.15	3.85	0.09	3.22	0.27	6.01	0.00	4.17	0.00	5.39	0.00	5.46	0.00
GDDS	-0.02	0.87	-0.02	0.87	-0.11	0.51	-0.11	0.51	0.02	0.88	0.09	0.64	0.03	0.84	-0.01	0.96	-0.04	0.78	-0.02	0.912								
SDDS	-0.03	0.80	-0.03	0.80	-0.21	0.11	-0.21	0.11	0.03	0.75	0.06	0.60	-0.10	0.21	-0.11	0.15	0.00	0.97	0.03	0.77								
US$ denominated bond (*)	0.57	0.00	0.57	0.00	0.59	0.00	0.59	0.00	0.31	0.04	0.28	0.10	0.26	0.03	0.23	0.04					0.71	0.00	0.22	0.00	0.43	0.00	0.44	0.00
Euro denominated bond (*)	0.18	0.11	0.18	0.11	0.19	0.36	0.19	0.36	0.08	0.60	0.01	0.97	0.02	0.89	-0.01	0.92					0.45	0.00						
LOG(maturity) (*)					0.01	0.88	0.01	0.88	0.04	0.37	0.01	0.87	0.04	0.41	0.05	0.25	0.06	0.17	0.06	0.26								
LOG(benchmark yield)					-0.20	0.13	-0.20	0.13	0.10	0.31	0.15	0.17	0.09	0.29	0.11	0.13	0.20	0.03	0.25	0.01			0.15	0.00				
POLRISK (*)					-0.02	0.01	-0.02	0.01	-0.02	0.00	-0.02	0.01	-0.02	0.00	-0.02	0.00	-0.02	0.00	-0.02	0.00	-0.02	0.00	-0.01	0.01	-0.01	0.01	-0.01	0.01
FINRISK (*)					-0.02	0.03	-0.02	0.03	-0.03	0.00	-0.03	0.01	-0.04	0.00	-0.04	0.00	-0.03	0.00	-0.03	0.00	-0.03	0.00	-0.03	0.00	-0.03	0.00	-0.03	0.00
FINOPEN					0.03	0.58	0.03	0.58	0.07	0.07	0.04	0.47	0.08	0.06	0.08	0.04	0.07	0.09	0.06	0.30			0.07	0.03				
FINDEPTH					0.00	0.97	0.00	0.97	0.00	0.75	0.00	0.42	0.00	0.68	0.00	0.65	0.00	0.72	0.00	0.40								
OUTGAP									-4.37	0.00	-5.05	0.00	-3.14	0.00	-3.12	0.00	-3.82	0.00	-4.47	0.00	-3.31	0.00	-3.05	0.00	-2.53	0.00	-2.43	0.01
GDP GROWTH (*)									0.01	0.06	0.02	0.17	0.00	0.63	0.00	0.66	0.02	0.02	0.02	0.06	0.01	0.09						
5-Y Growth Forecast									-0.03	0.35	-0.11	0.07	-0.03	0.42	-0.06	0.09	-0.04	0.11	-0.12	0.01			-0.07	0.02				
LOG(Debt-to-Export ratio) (*)									0.38	0.00	0.28	0.10	0.23	0.02	0.20	0.04	0.36	0.00	0.38	0.01	0.37	0.00	0.33	0.00	0.27	0.00	0.27	0.00
LOG(stdev inflation)									0.07	0.01	0.18	0.05	0.09	0.00	0.13	0.00	0.08	0.00	0.16	0.02			0.08	0.00	0.04	0.05	0.06	0.02
Gov. Balance / GDP (*)									-0.01	0.13	-0.03	0.32	-0.01	0.31	0.00	0.62	-0.01	0.17	-0.02	0.38			-0.02	0.06	-0.02	0.03	-0.02	0.05
Inflation Differencial (*)									-0.07	0.54	-1.08	0.42	0.01	0.65	-0.01	0.84	-0.04	0.65	-0.48	0.55								
RELATIVE PER CAPITA GDP									0.65	0.36	0.86	0.34	-0.50	0.54	-0.68	0.37	0.10	0.90	0.53	0.57								
RELSIZE									-0.99	0.23	-1.16	0.27	-0.46	0.63	-0.24	0.79	-0.29	0.73	-0.50	0.63								
IMF program (*)									0.13	0.01	0.20	0.02	0.10	0.04	0.15	0.03	0.10	0.04	0.16	0.05	0.14	0.03	0.22	0.00	0.15	0.01	0.22	0.01
Δ Fed Funds Rate (FFR)													-0.10	0.02	-0.10	0.02												
Surprises in FFR													0.74	0.04	0.64	0.06												
LOG(VIX)													0.47	0.00	0.51	0.00									0.53	0.00	0.53	0.00
LOG(stdev OIL prices)													0.15	0.05	0.15	0.03												
LOG(stdev World GDP growth)													0.01	0.66	0.01	0.67												
@TREND													0.00	0.59	0.00	0.40												
Periods	80		80		80		80		77		76		70		70		77		76		78		78		78		78	
Cross-sections	109		109		97		97		83		83		82		82		83		83		93		88		90		90	
Observations	682		682		581		581		488		484		472		469		488		484		583		525		546		544	
Adj. R^2	0.67		0.67		0.73		0.73		0.84		0.79		0.81		0.80		0.85		0.84		0.76		0.83		0.70		0.70	
Normality: No. of countries	95		95		86		86		76		71		70		72		73		75		83		77		76		76	

Source: Authors' calculations. Note: (*) indicates that the same or similar series were used in CP (2006); *p*-values computed using robust standard errors (cross-section clustering).

Table 14(b). Estimation Results—Yields

	Country Fixed Effects																Currency-Country Fixed Effects				Parsimonious Model							
	Period Fixed Effects												Global Control Variables				Period Fixed effects				(search routine with 10% significance)							
Model	Restricted Model				Policy and Bond Features				Full Set of Variables				Full Set of Variables				Full Set of Variables				Period Fixed Effects				Global Control Variables			
	OLS		GMM		OLS		GMM		OLS		GMM		OLS		GMM		OLS		GMM		OLS		GMM		OLS		GMM	
Variable	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*	Coef.	*prob.*
C	1.89	0.00	1.89	0.00	0.60	0.02	0.60	0.02	-1.68	0.08	-1.39	0.22	-1.60	0.10	-1.50	0.13	0.60	0.48	0.55	0.61	-2.13	0.01	-1.79	0.06	-2.22	0.00	-2.11	0.00
GDDS	0.12	0.10	0.12	0.10	0.02	0.71	0.02	0.71	0.04	0.48	0.04	0.53	0.05	0.36	0.04	0.41	0.02	0.76	0.02	0.73								
SDDS	0.02	0.79	0.02	0.79	-0.04	0.33	-0.04	0.33	0.03	0.46	0.05	0.23	-0.01	0.63	-0.02	0.42	0.03	0.52	0.05	0.28								
US$ denominated bond (*)	0.36	0.00	0.36	0.00	0.31	0.00	0.31	0.00	0.31	0.00	0.31	0.00	0.32	0.00	0.32	0.00					0.30	0.00	0.30	0.00	0.31	0.00	0.31	0.00
Euro denominated bond (*)	0.31	0.00	0.31	0.00	0.20	0.00	0.20	0.00	0.19	0.00	0.18	0.00	0.20	0.00	0.20	0.00					0.19	0.00	0.19	0.00	0.21	0.00	0.20	0.00
LOG(maturity) (*)					0.04	0.04	0.04	0.04	0.05	0.00	0.06	0.01	0.04	0.05	0.04	0.01	0.06	0.00	0.06	0.01	0.05	0.00	0.06	0.00			0.04	0.02
LOG(benchmark yield)					0.35	0.00	0.35	0.00	0.39	0.00	0.40	0.00	0.37	0.00	0.38	0.00	0.26	0.00	0.27	0.00	0.39	0.00	0.40	0.00	0.38	0.00	0.37	0.00
POLRISK (*)					-0.01	0.00	-0.01	0.00	-0.005	0.02	-0.01	0.03	-0.004	0.10	0.00	0.04	-0.01	0.01	-0.01	0.02	-0.01	0.01	-0.01	0.01			-0.004	0.03
FINRISK (*)					-0.01	0.00	-0.01	0.00	-0.01	0.00	-0.01	0.01	-0.01	0.00	-0.01	0.00	-0.01	0.00	-0.01	0.00	-0.01	0.00	-0.01	0.01	-0.01	0.00	-0.01	0.00
FINOPEN					0.00	0.90	0.00	0.90	0.02	0.24	0.01	0.38	0.01	0.36	0.01	0.28	0.02	0.24	0.01	0.42								
FINDEPTH					-0.003	0.00	-0.003	0.00	-0.004	0.00	-0.004	0.00	-0.004	0.00	-0.003	0.00	-0.01	0.00	-0.01	0.00	-0.004	0.00	-0.004	0.00	-0.004	0.00	-0.003	0.01
OUTGAP									-1.48	0.00	-1.52	0.00	-1.65	0.00	-1.60	0.00	-1.71	0.00	-1.78	0.00	-1.25	0.00	-1.23	0.00	-1.32	0.00	-1.36	0.00
GDP GROWTH (*)									0.00	0.22	0.01	0.17	0.00	0.53	0.00	0.52	0.01	0.07	0.01	0.06								
5-Y Growth Forecast									-0.01	0.19	-0.04	0.05	-0.01	0.43	-0.01	0.25	-0.01	0.24	-0.04	0.04			-0.03	0.04				
LOG(Debt-to-Export ratio) (*)									0.14	0.00	0.14	0.01	0.09	0.02	0.09	0.02	0.14	0.00	0.14	0.01	0.14	0.00	0.13	0.00	0.13	0.00	0.12	0.00
LOG(stdev inflation)									0.01	0.11	0.04	0.10	0.02	0.09	0.03	0.00	0.01	0.34	0.04	0.05			0.03	0.01			0.02	0.06
Gov. Balance / GDP (*)									0.00	0.14	-0.01	0.24	0.00	0.25	0.00	0.43	0.00	0.15	-0.01	0.20					-0.01	0.01		
Inflation Differencial (*)									-0.05	0.27	-0.23	0.46	-0.01	0.23	-0.02	0.03	-0.05	0.22	-0.30	0.32								
RELATIVE PER CAPITA GDP									0.47	0.07	0.42	0.20	0.10	0.71	0.09	0.72	0.21	0.45	0.21	0.59	0.47	0.06	0.51	0.06				
RELSIZE									-0.50	0.10	-0.38	0.31	-0.41	0.17	-0.38	0.20	-0.05	0.87	0.04	0.93	-0.61	0.03	-0.58	0.05	-0.37	0.00	-0.34	0.01
IMF program (*)									0.03	0.17	0.07	0.02	0.01	0.44	0.05	0.06	0.03	0.12	0.07	0.04			0.08	0.01			0.06	0.03
Δ Fed Funds Rate (FFR)													0.00	0.97	0.01	0.70												
Surprises in FFR													-0.13	0.37	-0.16	0.23												
LOG(VIX)													0.15	0.00	0.18	0.00									0.11	0.00	0.14	0.00
LOG(stdev OIL prices)													0.08	0.01	0.09	0.00									0.07	0.00	0.09	0.00
LOG(stdev World GDP growth)													0.01	0.57	0.01	0.44												
@TREND													0.00	0.02	0.00	0.02											0.00	0.02
Periods	95		95		84		84		81		80		74		74		81		80		83		81		84		82	
Cross-sections	135		135		98		98		84		84		83		83		84		84		85		84		85		84	
Observations	1210		1210		623		623		529		525		513		510		529		525		535		527		541		535	
Adj. R^2	0.49		0.49		0.79		0.79		0.87		0.86		0.85		0.85		0.88		0.86		0.87		0.86		0.85		0.85	
Normality: No. of countries	114		114		95		95		76		76		73		76		77		74		77		79		72		76	

Source: Authors' calculations. Note: (*) indicates that the same or similar series were used in CP (2006); *p*-values computed using robust standard errors (cross-section clustering).

99. More generally, a reason to complement the econometric analysis with event studies is that, despite our efforts to control for the effects of other factors (i.e., aside from SDDS/GDDS subscription or use of the Reserve Template), it is not completely guaranteed that panel regressions such as those used in the previous sections can replicate a random experiment closely enough for statistical inference to be appropriately carried out.

100. Event studies give up the notion of simulating a random experiment. They focus only on situations where the variable of interest, z, is observed both before and after the relevant event, k, which supposedly affects z. To isolate the effect of k on z, the analysis is limited to a sufficiently narrow "event window" $[t_0\text{-}s, t_0\text{+}s]$, around the time of the event's occurrence, t_0. The window s needs to be short enough such that the importance of other factors affecting z is negligible relative to the importance of the event itself. On the other hand, a very short window may preclude a proper identification of the effect of the event in case it takes time to materialize.

101. In analyzing the effect of IMF data standards, we consider three cases:

	Event (k)	Variable of Interest (z)	Data Frequency	Event Windows (s)
Case 1	SDDS	Gross FDI (% GDP)	Quarterly	1, 2, 4, 8
Case 2	Reserve Template	Exchange Rate Volatility	Monthly	3, 6, 12, 24
Case 3	SDDS, GDDS	Sovereign Yields, Spreads	Quarterly	1, 2, 4, 8

102. In particular, we estimate the following regression:

$$z_{it} = \beta + \alpha_i + \eta_t + \lambda k_{it} + \varepsilon_{it}, \qquad (6)$$

where z_{it} is the variable of interest—gross FDI inflows (in percent of GDP), the volatility of the nominal exchange rate (monthly standard deviation from daily data, in logs), or sovereign borrowing costs on new bond issuances (both yields and spreads); β is a constant; α_i and η_t are country-specific and period fixed effects, respectively; k_{it} is a dummy variable indicating whether country i, has received the "treatment" (subscription to IMF data standards or use of the Reserve Template) by time t; and ε_{it} is an error term.

103. The parameter of interest is λ. As a way to compromise between using a short or a long event window, we (i) present results for different windows (one quarter, half year, one year, and two years), and (ii) estimate a modified version of equation (6) in which the period fixed effects are replaced by a vector of global control variables, Ψ_{it}:[59]

$$z_{it} = \beta + \alpha_i + \theta\Psi_{it} + \lambda k_{it} + \varepsilon_{it}. \qquad (7)$$

[59] Vector Ψ_{it} includes variables to capture global liquidity conditions (actual and unanticipated change in U.S. short-term interest rates) and global risk (VIX index of market volatility). See Annex 1 for details. When estimating equations (6) and (7) for Case 2, the vector of control variables also includes dummy variables for fixed, pure floating, and dirty floating exchange rate regimes (relative to the U.S. dollar). In estimations associated with Case 3, bond characteristics—notional amount, maturity, and dummy variables for currency denomination—were also included as controls. The complete results are available upon request.

104. Table 15 shows the estimated values of λ (along with associated p-values) in equations (6) and (7) applied to case studies 1–3. The results suggest that:

- Meeting the criteria for SDDS subscription does not have a discernible positive effect on FDI inflows, regardless of the time window around the treatment date or of the specification used: estimated coefficients do not always show the expected positive sign and are never statistically significant.

- The use of the Reserves Template does not reduce exchange rate volatility: the estimated coefficient on RT is always *positive*, regardless of the window and specification. When using period fixed effects, these coefficients are never statistically significant, but when global control variables are used to account for common factors possibly affecting all countries simultaneously, the positive effect on volatility becomes statistically significant in the case of longer time windows (half-year, one-year and two-year windows).[60]

- Subscription to the SDDS does not produce any statistically significant effect on sovereign spreads or yields of newly issued bonds: estimated coefficients typically show the wrong (positive) sign and are not statistically significant, except for the shortest window (one quarter), when the estimated coefficient of SDDS indicates a statistical significant *increase* in sovereign borrowing costs.[61]

105. In summary, the results of the event studies discussed in this section are consistent with our conclusions from the three previous sections and provide additional support for skepticism regarding the benign effects of subscription to IMF data standards on FDI flows, exchange rate volatility, and sovereign borrowing costs reported by IMF research.

VII. Assessment and Conclusions

106. The IMF's data dissemination initiatives are designed with a view to help countries improve their statistics dissemination practices. In doing so, they are expected to increase transparency about the macroeconomic and financial situation of participating countries and reduce noise-to-signal ratios for investors. Some IMF research suggests that this channel can significantly affect a country's FDI inflows, exchange rate volatility, and sovereign

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[60] For Case 2, however, it is reasonable to think that a shorter event window is the most appropriate, given the higher-frequency nature of the daily movements in exchange rate that were used to construct the monthly volatility measure (standard deviation). Longer time windows more likely allow other factors, especially when imperfectly captured by global control variables, to be at play. That may explain the statistical significance of the positive effect of RT on exchange volatility based on the estimation of (7) for the longer time windows.

[61] The positive and significant estimated effect of SDDS on spreads within a one-quarter window is driven by bond issuances from one country (Israel), which, given the small sample available, accounts for half of the observations. Removing that country from the sample makes the estimated RT effect no longer significant. For yields, a similar situation occurs with three countries: removing Israel, Argentina, and Sweden—which account for 60 percent of the small sample—makes the effect of RT in the estimation of (7) for the shortest window no longer significant.

borrowing costs. These findings presumably validate the IMF's efforts to support and allocate its limited resources to data dissemination initiatives, rather than to other successful initiatives within its Statistics Department that compete for the same pool of resources. They also act as a motivation for IMF member countries to invest in their data dissemination practices aiming at meeting the subscription requirements of these initiatives.

Table 15. Event Studies Estimated Values of λ

Case 1: SDDS and Gross FDI Inflows (% of GDP)								
	8 Quarters		4 Quarters		2 Quarters		1 Quarter	
	Period FE	Global Controls	Period FE	Global Controls	Period FE	Global Controls	Period FE	Global Controls
SDDS	0.42	0.51	0.09	0.48	-0.29	0.57	-0.76	1.61
p-value	0.27	0.22	0.84	0.33	0.55	0.42	0.36	0.35
Obs	937	937	501	501	278	278	167	167
Cross-sections	58	58	57	57	56	56	56	56
Adj. R^2	0.81	0.77	0.86	0.71	0.98	0.55	0.99	0.59
Case 2: Exchange Rate Volatility								
	24 Months		12 Months		6 Months		3 Months	
Treatment	Period FE	Global Controls	Period FE	Global Controls	Period FE	Global Controls	Period FE	Global Controls
RT	0.10	0.08	0.03	0.10	0.01	0.09	0.01	0.04
p-value	0.17	0.09	0.55	0.00	0.90	0.01	0.91	0.32
Obs	2760	2760	1414	1414	739	739	399	399
Cross-sections	58	58	58	58	57	57	57	57
Adj. R^2	0.83	0.81	0.89	0.87	0.91	0.88	0.94	0.90
Case 3: Spreads (basis points)								
	8 Quarters		4 Quarters		2 Quarters		1 Quarter	
Treatment	Period FE	Global Controls	Period FE	Global Controls	Period FE	Global Controls	Period FE	Global Controls
SDDS	0.17	0.20	0.37	0.11	0.54	0.17	1.04	1.27
p-value	0.67	0.26	0.28	0.60	0.24	0.56	0.04	0.01
Obs	358	358	269	269	150	150	85	85
Cross-sections	22	22	19	19	15	15	6	6
Adj. R^2	0.62	0.61	0.68	0.67	0.67	0.67	0.74	0.70
Case 3: Yields (% per year)								
	8 Quarters		4 Quarters		2 Quarters		1 Quarter	
Treatment	Period FE	Global Controls	Period FE	Global Controls	Period FE	Global Controls	Period FE	Global Controls
SDDS	-0.04	-0.02	0.10	0.02	0.14	0.04	0.25	0.19
p-value	0.27	0.71	0.40	0.75	0.24	0.42	0.13	0.01
Obs	463	463	320	320	177	177	91	91
Cross-sections	25	25	21	21	17	17	6	6
Adj. R^2	0.65	0.66	0.65	0.62	0.71	0.69	0.70	0.69

Source: Authors' calculations.

107. In this paper, we tested the robustness of IMF research findings regarding the effects of the data standards initiatives on inflows of foreign direct investment; exchange rate volatility; and spreads on sovereign bonds. First, we failed to confirm a positive correlation between participation in the data standards initiatives and an increase in transparency related to availability of information. Since this is the main proposed channel of transmission of the

effects of subscription to data standards initiatives on investor decisions, our finding weakens the main thesis of the IMF studies that have tried to establish a link between the data initiatives and beneficial outcomes in terms of access to capital markets and exchange rate volatility.

108. Moreover, we found that the positive effects that these studies have reported on FDI inflows—a 60 percent increase after countries meet the requirements to subscribe to SDDS—are based on inadequate methodology or data, or both. When shortcomings in the methodology are corrected and more plausible transformations of the data are used—even when we rely on the original (raw) dataset and model used in the IMF research—the result no longer holds.

109. We also found that the effect of the RT on exchange rate volatility was not properly measured in IMF research. Regardless of how sound the econometric strategy of the IMF study was (which, incidentally, is up for debate), its findings are based on a misinterpretation of the results. More specifically, the IMF researchers only considered the direct effect of RT implied by their estimates, neglecting the indirect effects also featured in their model. Using their own data, once we account for these indirect effects or re-estimate the underlying model without assuming indirect effects, the results indicate no statistically significant effect of RT on exchange rate volatility. Our series of alternative models—applied to an updated dataset that includes more recent periods and additional countries—also fail to capture any negative effect of RT on exchange rate volatility.

110. Finally, robustness tests implemented on the same dataset and model used by the IMF researchers, as well as our own estimations using different setups applied to an extended and updated sample, call into question the conclusion that SDDS/GDDS participation reduces sovereign borrowing costs. Both exercises indicate that correcting the distortions introduced by the IMF's analysis into the data on bond spreads and yields, and controlling for the effect of common factors that could potentially affect borrowing costs in all countries regardless of SDDS/GDDS participation, is enough to cast serious doubts on the findings. Thus, contrary to the original results by the IMF researchers, our results do not suggest that data initiatives have any negative and statistically significant effect on the borrowing cost for subscribing countries to tap international sovereign bond markets.

111. The lack of robustness of the effects of IMF data standards on the selected variables is confirmed by event study analyses.

112. In conclusion, the beneficial effects of IMF data standards initiatives on FDI inflows, exchange rate volatility, and sovereign borrowing costs, reported in three IMF research papers publicly available and used to advertise the benefits of such data initiatives, do not seem to survive simple robustness checks based on a "cleaning" and updating of the data, nor slight modifications to the underlying econometric strategies originally used by IMF researchers.

113. It should be stressed that our findings have no implications for other potential benefits associated with the IMF data standards initiatives. IEO (2016), for example, reports on the positive impacts of these initiatives on data quality and on how third parties perceive national data disseminated through the initiatives.

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ANNEX 1. DATA

This annex describes the data and sample used in the paper.

1. Series used in Section II (annual frequency)

- *FDI*: calculated using FDI flows (*WEO* or *IFS*) as percentage of GDP in U.S. dollars *(WEO)*.
- SDDS: dummy variable constructed using the subscription dates, which are available on the IMF's website at http://dsbb.imf.org/Pages/SDDS/Home.aspx
- Change in short-term U.S. interest rates: first-difference in the principal component of the Federal Funds Rate and the rates of three-month Treasury Bill (available in the *IFS* repository), in percent per year).
- Global risk: principal component of the VIX—market volatility index published by the Chicago Board Options Exchange—and TED spreads (in percentage points).[1]
- World real GDP growth: year-over-year rate of growth of the world GDP (from *WEO* or *IFS*; in percent per year).
- World FDI/GDP: for each country *i*, it is the sum of FDI inflows across countries, excluding country *i*, in percent of the cross-country sum of nominal GDP in US dollars, also excluding *i*.
- FINDEPTH: ratio of domestic liquid liabilities to GDP from the dataset in Beck, Demirgüç-Kunt, and Levine (2000 and 2009), and updated to November 2013.
- FINOPEN: de jure index of financial openness from Chinn and Ito (2006, 2008, 2011).
- FINEXPOUS: constructed following *WEO* (2011, p. 156) as country *i*'s sum of U.S. asset holdings and liabilities to the U.S.—including securities, bank loans, and assets and liabilities of non-banking enterprises—as a share of the sum of its total international external asset and liability positions. Data on assets and liabilities are from the *IFS*.
- RESCUR: average share (over the sample period) of world foreign exchange reserves held in country *i*'s currency, obtained from the IMF's Currency Composition of Official Foreign Exchange Reserves (COFER) database, normalized by the U.S. dollar share.
- TRADEOPEN: sum of imports and exports as percentage of GDP (from *WEO* and *IFS*), expressed in deviations from its cross-country GDP weighted average, to correct for a unit root.
- POLRISK: index of political risk published by the International Country Risk Guide (ICRG). Higher scores indicate lower risk.

[1] The difference between the three-month T-bill interest rate and the three-month London Interbank Offered Rate (LIBOR), computed by the Chicago Mercantile Exchange.

- INV/GDP: investment as percentage of GDP (*WEO*, *IFS*).
- Five-year-ahead growth forecasts: *WEO* forecasts of real GDP growth (in percent per year).
- Relative per capita GDP: relative per capita GDP in U.S. dollars vis-à-vis the United States (*WEO*, *IFS*).
- Change in NFA position: first difference in net foreign asset positions (*WEO*, *IFS*), normalized by GDP, both in U.S. dollars.
- PPP-adjusted real exchange rate: computed as percent deviation from its HP-trend (*WEO*, *IFS*).
- Foreign exchange crisis dummy: takes the value of one if a country-year observation is identified as an "outlier" (see Annex 2) *and* the percentage change of the PPP-adjusted real exchange rate is both positive (i.e., a depreciation) and higher than two standard deviations from its mean.
- Dummy variables for exchange rate regimes: constructed using the Levy-Yeyati and Sturzenegger (2005) *de facto* three-way classification.

2. Series used in Section III (quarterly frequency, unless stated otherwise)

- Exchange rate volatility (*V*): standard deviation of the daily percentage change (first difference of the natural logarithm) in the nominal exchange rate (from *WEO* and *IFS*, in domestic currency per U.S. dollar) within a quarter.
- RT: dummy variable constructed using dates of countries' first use of the "Reserve Template," available at http://dsbb.imf.org/Pages/SDDS/ReserveTemplates.aspx.
- Indebtedness (*D*): annual gross government debt position or external debt stocks (both from *WEO*) as percentage of GDP in domestic *(IFS)*) or U.S. dollars *(WEO)*, respectively. Because of panel unit roots, this series was detrended using its GDP-weighted cross-country average or an HP trend.
- Reserve adequacy (*RA*): quarterly series of foreign reserve holdings *(IFS)*) as percentage of the annual stocks of short-term external debt *(WEO)*. When the latter data are not available, we use total external debt *(WEO)*. The final series is expressed in logs.
- Volatility of benchmark currency: standard deviation of the monthly percent change, within a year, in the nominal exchange rate of country *i* against a currency of reference as defined in LYS (2005).
- Interest rate differential: difference between money market rates or the rate in three-month government bonds relative to their counterparts in the United States (*WEO*, *IFS*).
- GDP growth: quarterly percent change in real GDP *(WEO)*. When not available, we use the annual GDP rate, repeated every quarter.

- Inflation: annual rate of growth of the consumer price index *(IFS)*.
- Volatility of money growth: standard deviation of month-to-month growth rates of broad money for the twelve-month period ending each quarter *(IFS)*.
- CA/GDP: Current account balance *(IFS)*) as a ratio to GDP *(IFS)*.
- Δ (GOV. BAL/GDP): first difference in government balance *(WEO)* as percentage of GDP *(IFS* and *WEO*).
- The following series—available at annual frequency–are defined as in Section II and repeated in all quarters within a given year:
  - The dummy variables for exchange rate regimes, POLRISK, FINRISK, FINOPEN, and FINDEPTH.
- The following series are defined as in Section II, but computed using quarterly data:
  - TRADEOPEN, OUTPUT GAP.
- Federal Funds Rate (FFR): from the U.S. Federal Reserve, in percent per year.
- "Surprises" in FFR: we considered the change in the settlement price of futures contracts of Fed funds within one day after regular meetings of the Federal Open Market Committee (FOMC) as a proxy of unanticipated changes in the U.S. monetary policy rate (see *WEO*, 2011: 156–60).
- VIX: quarterly average of daily values of the market volatility index (CBOE).
- Volatility of oil prices: standard deviation (within a quarter) of daily oil prices (Haver Analytics).
- Volatility of world economic growth: standard deviation (within the past four quarters) of quarterly world real GDP growth *(WEO)*.

3. Series used in Section IV (quarterly frequency, unless stated otherwise)

- Bond characteristics (yields, spreads, maturity, benchmark yields, and currency denomination): from the *Bonds, Equities, and Loans* (BEL) database.
- SDDS and GDDS: dummy variables constructed using the subscription dates, which are available on the IMF's website at http://dsbb.imf.org/Pages/SDDS/Home.aspx.
- Federal Funds Rate (FFR), surprises in FFR, VIX, volatility of oil prices, and volatility of world economic growth: same as defined above.
- Debt-to-export ratio: from the World Bank's *Global Development Indicators*.
- Volatility of Inflation: standard deviation (within a quarter) of the monthly rate of consumer price inflation *(IFS)*.

- RELSIZE: relative GDP in U.S. dollars vis-à-vis the United States (*WEO*, *IFS*). Annual figures repeated every quarter within a year.
- IMF: dummy variable for participation in IMF-supported programs.
- The following series are as in Section III:
  - The dummy variables for exchange rate regimes, POLRISK, FINRISK, FINOPEN, FINDEPTH, OUTPUT GAP, GDP growth, GOV. BAL./GDP,
- The following series—available at annual frequency—are defined as in Section II and repeated in all quarters within a given year:
  - Relative per capita GDP: relative per capita GDP in U.S. dollars vis-à-vis the United States (*WEO*, *IFS*);
  - Five-year-ahead growth forecasts: *WEO* forecasts of real GDP growth (in percent per year).

Note on series computed as ratio to GDP at quarterly frequency:

For any variable Z that is mainly available at annual frequency, we proceed in six steps as follows: (i) compute its ratio to *annual* nominal GDP; (ii) repeat the annual Z-to-GDP ratios for every quarter within a given year; (iii) extract its HP-trend, $\mathrm{HP}(Z/\mathrm{GDP})$; (iv) multiply the cyclical part by the annual GDP to construct an estimate of the cyclical component, $\hat{Z}$, at quarterly frequency; (v) compute the ratio of $\hat{Z}$ to *quarterly* GDP; (vi) add back the trend. The final series is then $\hat{Z}/\mathrm{GDP}(q) + \mathrm{HP}(Z/\mathrm{GDP})$.

The quarterly series of GDP used in the above transformation is either in U.S. dollars or domestic currency depending on the unit of Z. In both cases, given that data for Z are annual, we compute an "annualized" moving sum of quarterly GDP such that annual GDP is equal to quarterly GDP at the fourth quarter:

$$\mathrm{GDP}_t(q) = \sum_{i=0}^{3} \mathrm{GDP}_{t-i}$$

Annex 2. Detection of Outliers

This annex describes the methodology used to detect outliers. For any variable Z_t the following regression is estimated *for each* country i (i.e., not in panel):

$$Z_{it} = c + e_{it}, \quad \text{(A)}$$

where c is a constant and e_{it} is an error term.

Based on the residuals from Equation (A), seven different "influence statistics"—measures of the effect of a single observation on the regression—are computed. These are described below. We exclude from the sample any observation that satisfies the definition of outlier on at least three criteria.

Influential Statistics

1) *Leverage value*, h_{it}: the diagonal element of the "hat matrix" (or projection matrix), which maps the vector of observed values to the vector of fitted values.[1] Absolute values of hit larger than $3/n$, where n is the number of observations, are deemed influential.

2) *Studentized residual*: the estimated residual at observation *it* divided by an estimate of its standard deviation:

$$\bar{e}_{it} = \frac{\hat{e}_{it}}{s_{it}\sqrt{1-h_{it}}}, \quad \text{(B)}$$

where $\hat{e}_{it}$ is the original residual from Equation (A) for observation it, s_{it} is the variance of the residuals that would have resulted had that observation not been included in the estimation, and h_{it} is the leverage value. Absolute values of $\bar{e}_{it}$ higher than the critical value of the *t*-distribution with n-1 degrees of freedom are treated as outliers.[2]

3) *Dropped residual*: the residual for observation *i* had the equation been run without it. It follows a *t*-distribution with n-2 degrees of freedom.

4) *Scaled studentized residual:* computed by scaling $\bar{e}_{it}$ by an estimate of the standard deviation of the regression fit:

[1] In a regression of the type Y=XB+Σ—where Y is a n×1 vector containing n observations of the dependent variable, X is a n×k matrix of k regressors (including a constant term), B is a k×1vector of coefficients, and Σ is a k×1vector of regression errors—the vector of fitted values is given by $\hat{Y}$=HY, where $H=X(X'X)^{-1}X'$ is the hat matrix.

[2] The residual $\bar{e}_{it}$ is also numerically identical to the *t*-statistic that would result from putting a dummy variable in the original equation, which is equal to one on that particular observation and zero elsewhere. Thus, it can be interpreted as a test for the significance of that observation. We considered 5 percent significance levels.

$$e_{it}^{*} = \left(\frac{h_{it}}{1-h_{it}}\right)^{1/2} \bar{e}_{it}. \quad \text{(C)}$$

Outliers are observations for which the absolute value of e_{it}^{*} are larger than $2(1/n)^{1/2}$.

5) *Cook's Distance:* a measure of the aggregate impact of each observation on the group of regression coefficients, as well as the group of fitted values:

$$C_{it} = \tilde{e}_{it}{}^{2}\left(\frac{h_{it}}{1-h_{it}}\right), \quad \text{(D)}$$

where $\tilde{e}_{it} = \hat{e}_{it}/(\sigma_e\sqrt{1-h_{it}})$ is the "standardized residual", and σ_e is the standard error of the original regression (A). The cut-off for above which an observation is classified as an outlier is the critical value of the *F*-statistic with 1 and n-1 degrees of freedom in the numerator and denominator, respectively.

6) *Covariance ratio*: the ratio of the determinant of the covariance matrix of the coefficients from the original equation to the determinant of the covariance matrix from an equation without that observation. This statistic measure the impact of each observation on the variances (and standard errors) of the regression coefficients and their covariance coefficients. Values lower than $1-(3/n)$ or greater than $1+(3/n)$ are considered associated with outliers.

7) *DFBETAS*: the scaled difference in the estimated coefficients between the original equation and an equation estimated without that observation:

$$b_{it} = \frac{\hat{c}-\hat{c}(it)}{s_{it}\sqrt{var(\hat{c})}}, \quad \text{(4)}$$

where $\hat{c}$ is the estimated constant in (1), $\hat{c}(it)$ is that coefficient's estimate without observation *it* and $var(\hat{c})$ is the variance of$\hat{c}$. This measure assesses how much an observation has affected the estimated coefficient. Values larger than $2/\sqrt{n}$ are associated with outliers.