The Economic Impact of Corruption Scandals in Latin America: Evidence from the Sovereign Bond Market

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Abstract: We explore seven Latin American (LATAM) countries from 2011 to 2018 to assess whether corruption scandal events induce sovereign spreads reactions and consequently affect economic soundness. We focus on the direct and short-term reactions of sovereign spreads and investigate the medium-term impact of scandal events on economic soundness. We find that corruption scandal announcements instantaneously inflate sovereign spreads; the next-day impact is even stronger. Corruption scandals in one country are found to positively impact neighbouring countries (through sovereign yield deflation mechanisms) but induce lower FDI inflows and inverse contagion effects in the wider region. These results highlight the critical role played by scandals in the dynamics of borrowing costs faced by LATAM economies. The results may be employed by policymakers to forecast the consequences for their country's cost of debt and modify fiscal strategies accordingly.

Keywords: Corruption; Latin America; Sovereign bonds; spreads; scandal.
JEL Classification: C33, G12, G14, D73.

1. INTRODUCTION

Emerging bonds' yields constitute a standard measure of country risk and fairly reflect international bond holders risk perceptions. Investors closely monitor key macroeconomic variables, political news, and financial markets to assess countries' ability-to-repay their debts, and price their bonds accordingly. Shocks to economic outlooks or political stability entail swift market reactions through a repricing of bonds (Moser 2007). Sovereign bond holders' perceptions and investing behavior are important because they affect both the supply and cost of capital flows that emerging countries critically need. The economic soundness of these countries is hindered by inflated investment costs.

Bond holders assess country-risk exposure, through fundamentals, perceptions, or herd movements (Waisman et al. 2015). Markets then price in risk premia which impact the cost of new debt. The highly volatile cost of debt in emerging countries has been the source of their financial distress (González-Rozada et al. 2008): developing countries should strive to reduce investor's risk perceptions.

Corruption scandals offer a unique context to study the behavior of international sovereign-bond holders' reactions in the market. A better understanding of spreads variations in times of uncertainty can be of high value for both active international investors and emerging countries' fiscal administration in predicting cost of debt. Anecdotal evidence shows that political turmoil around corruption topics can significantly impact the sovereign bond market of a country.

From 2014 to 2018, LATAM countries witnessed a boom of corruption scandals initiated by Brazil's *Operation Car Wash* (Pacheco 2017), leading to Brazil's economic recession and political instability. (The Brazilian economic recession – like all recessions – was more nuanced, however, and stemmed from several factors. In 2014, President Rousseff increased government debt and postponed (government-imposed) price increases, to the dismay of her economic advisors. Although re-elected, her actions precipitated dire economic ramifications which only became manifest in 2015.). We investigate the impact of these scandals on the region's economic health through debt markets and international investor risk perception. Understanding the dynamics of sovereign yields' reactions to corruption scandals is relevant for economists and financial researchers. Despite their spatio-temporal uniqueness, our findings can be used as a stress test analysis on sovereign spreads. Our conclusions have implications for emerging countries' policymakers, cost of debt forecasts and fiscal policy strategies.

We contribute to the existing literature on the impacts of corruption by studying specific corruption scandal cases, documenting the determinants and dynamics of sovereign spreads and validate previous findings. We find useful implications for international bond holders and for LATAM policymakers: through a better understanding of sovereign yield dynamics and reactional mechanisms to corruption scandals, bond holders may optimise their returns by adjusting investment strategies. Policymakers can also use our results to pre-

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dict their country's cost of debt and modify their fiscal strategies accordingly.

2. LITERATURE REVIEW

Much research has been conducted on the economic consequences of political risk[i] at a firm-market and macro level; here we focus on the uncertainty shock's impact on macroeconomic conditions. Alexopoulos and Cohen (2009) correlate political uncertainty with lower levels of output, employment, productivity, consumption, and investment. Their research argues that political unrest can prompt short but fierce economic recessions. Baker and Bloom (2013) warn about the assumption of causality which has not yet been determined. It is still unclear whether political uncertainty drives recessions or the opposite. Foreign Direct Investments (FDI) are also more volatile in times of uncertainty (Click 2005). Notably, a 1% reduction in political risk incites a 12% increase in FDI[ii] (Bekaert et al. 2014).

Research is mostly conceptual due to a lack of quality data (Click 2005) forcing scholars to use questionable proxies. Political uncertainty is not directly observable and differentiating it from general uncertainty can be challenging (Kaviani et al. 2017). Corruption is typically viewed as a component of political uncertainty through the emblematic distorted public investment decisions of corrupt institutions (Shleifer and Vishny 1993). Citron and Nickelsburg (1987) show that political instability significantly affects sovereign probability of default. Moser (2007) measures political uncertainty as cabinet reshuffles in LATAM countries and finds significant turbulence in sovereign spreads.

Sovereign defaults operate through the ability and willingness to pay – high corruption levels affect both, the former through economic deterioration through lower tax revenue (Johnson, Kaufmann and Zoido-Lobaton 1999; Tanzi and Davoodi 1997), and the latter from government decisions which adversely impacted the welfare of the country (Bulow and Rogoff 1989; Shleifer and Vischny 1993; Tanzi and Davoodi 1997).

Spread changes rely less on political variables and fundamentals, and more on market sentiment (Eichengreen and Mody 1998). Balding (2011) and Özatay et al. (2009) point to the effect of herding behavior on emerging countries' sovereign bonds market and find substantial contagion effects. Yield inflation of one emerging economy influences neighbouring countries, even when neighbours do not suffer any negative changes in economic outlooks. Gande and Parsley (2003) show that a credit rating downgrade on an emerging country negatively affect regional neighbours.[iii]

Most research argues that corruption cripples the growth of developing countries, while others claim it can be beneficial for countries with malfunctioning institutions. Mauro (1995) vigorously rejects the 'beneficial' assertion and demonstrates that corruption lowers investment and growth. the first one shows corruption increases the amount of bureaucratic interference (Gaviria 2002) and the latter that independently from its impact on investment, corruption also adversely affects growth (Méon and Sekkat 2005).

Other researchers suggest that corruption could be beneficial because of an enhanced velocity of capital flows, and secondly through incentives of government officials to work harder. Méon and Weill (2010) showed that corruption alleviates distortions caused by government institution inefficiencies.

Different types of corruption which impact growth at a country-level have been identified through lower levels of FDI (Cuervo-Cazurra 2008) and investment quality (Lambsdorff 2003a). Shleifer and Vishny (1993) explain the sluggish growth in highly corrupt countries by a redirection of public resources to areas that are less development driven. Pellegrini and Gerlagh (2004) find that corruption is linked to levels of trade openness, schooling and political instability and it impacts negatively on GDP levels (Lambsdorff 2003b and Svensson 2005).

Corruption is harmful to economies,[iv] but corruption levels and corruption scandals must, once again, be dissociated. Investors may respond to scandals differently – shunning a sovereign if it is plagued by a high level of corruption but potentially embracing it if they consider that a scandal is a sign of improvement of the country in its fight against corruption.

Depken, Lafountain and Butters (2006) found a significant relationship between corruption levels and sovereign spreads: were a sovereign's corruption levels to shrink by one standard deviation, its credit rating improve by one rating category, leading to savings of about US$10,000 for every US$1 million of sovereign debt. Ciocchini, Durbin and Ng (2003) demonstrate that a 1% increase in a sovereign's CPI score leads to a 26% decrease in spreads on average, suggesting that investors require a significant risk premium for investing in more corrupt countries.

Apergis & Apergis (2019) undertook an empirical analysis of a panel of 120 countries, from 1999 – 2015 and found a non-linear relationship between corruption and debt. The authors also found a pronounced threshold effect: public debt responded faster to a high corruption regime compared to a low corruption regime, while the debt to GDP ratio was inflated by increases in the shadow economy size, the inflation rate government expenses, military expenditure, and debt interest payments.

Bitterhout & Simo-Kenge (2020) explore the prevalence and impact of corruption on economic growth in BRICS countries using a panel dataset over the period 1996 to 2014 and find a negative association between output growth and corruption index.

The erosion of political trust in Spain due to corruption between 1997 and 2019 was explored by Torcal & Christmann (2021). Using two longitudinal datasets (a repeated cross-sectional dataset from the Spanish samples of Eurobarometer and an individual-level panel survey conducted during a period of economic recovery in 2015) the authors found that perceptions about political corruption and responsiveness matter greatly in shaping political trust and a nation's economic performance. The study also found evidence that trust in the judicial system was affected by perceptions of corruption.

Our analysis only focuses on the direct impact of corruption scandals on sovereign spreads. Even though we expect large corruption scandals to reflect on macroeconomic indicators

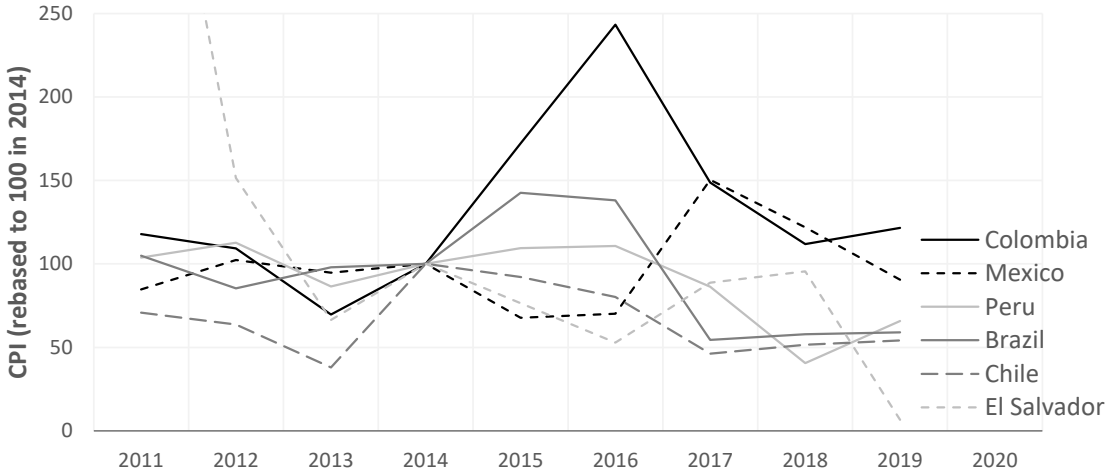

Fig. (1). Annual CPI in LATAM from 2011 to 2019, rebased to 100 in 2014.
Source: The World Bank.

as well such as GDP growth, which, in turn, will impact sovereign spreads, this indirect impact is beyond the scope of this work. We focus exclusively on sovereign bond holders' reactions to shocks related to corruption.

LATAM is plagued by failing public institutions, high corruption levels and large informal sectors. Lagunes, Yang & Castro (2019) argued that the pervasive influence of corruption in Latin America gave rise to much concern amongst potential investors. The authors analysed survey-based measures of corruption from Transparency International (2018) and the Latin American Public Opinion Project (Americas Barometer 2016) and confirmed that Latin America's average corruption level was relatively high, with little signs of improvement. The analysis further showed that higher rates of perceived corruption were associated with lower levels of economic welfare and direct foreign investment in the region. Governments have adopted numerous anti-corruption measures to palliate these issues. This has led to a corruption scandal boom in the region, as investigating organizations unveil hundreds of corruption schemes. Most importantly, Operation Car Wash was a Brazilian-led country-wide corruption investigation launched in 2014 (Pacheco 2017). The investigation uncovered money laundering, bribing and embezzlement schemes going on in Brazil and other countries of LATAM. The Odebrecht scandal led to corruption scandals and arrests in Argentina, Mexico, Panama, Peru, and Venezuela, and to sovereign spreads inflating leading to a Brazilian yield peak at 14% in December 2015. Fig. (**1**) shows the degradation of CPI scores after 2014 across LATAM countries, reflecting the impact of Operation Car Wash on corruption perception in this region.

We avoid flawed corruption indicators by measuring the visible elements of corruption. Literature is scarce on corruption scandal red flags and the true effects of corruption, due to a lack of public data. Fan et al. (2008) and Pan and Tian (2017) are two exceptions, using corruption scandals in China to demonstrate and investigate the changes in behaviors of bribing firms. We create our own dataset by handpicking numerous observations of corruption scandals from LATAM countries, through news releases.

Several hypotheses are set concerning the impact of global factors on sovereign spreads, the impact of recession on the corruption scandal reaction effect, and the existence of a spillover effect. Our main hypothesis is that sovereign bond holders react strongly and negatively to corruption scandals reflecting on a sudden swelling of sovereign spreads unexplained by other political and economic variables.

The literature on emerging bonds is large and growing, pushed by the flourishing interest of international higher-rent-seeking investors. To the best of our knowledge, this represents the first study to take advantage of LATAM's corruption scandals boom to explore interactions between scandals, spreads, and economic outcomes. We run a quantitative analysis on the short-term reactions of debt markets on scandals' announcement day and the following day. We explore the intricacies of scandals lifecycles to demonstrate markets' differences of reactions depending on the type of announcement. Finally, we speculate on the medium-term economic impacts of corruption scandals.

3. MATERIALS AND METHODS

We select seven LATAM countries: Brazil, Chile, Colombia, Mexico, Peru, El Salvador, and Venezuela[v] spanning seven years from April 2011 to April 2018. All countries are known for their struggle against corruption (to different extents) and have seen several scandals disturbing their economy over the studied period. The countries' sizes and economic outlooks all vary, and their governments hold different views on the controversial issue of public corruption. Anti-corruption policies vary in scale, scope, and efficiency. Media reaction and publicly available information following a corruption scandal differs.[vi]

We provide first evidence of a significant link between sovereign spreads and corruption scandals with a mean-comparison test (Moser 2007). We withdraw the pre-scandal and post-scandal levels of spreads and compare them with a Wilcoxon non-parametrical[vii] hypothesis test. The analysis is conducted on equal lengths by comparing spreads levels five (ten, 20, 40, 60 and 80) days before and after the scandal. Table **1** shows levels of confidence.

Table 1. Wilcoxon Test (Non-parametric).

Sample\Period	-5/+5	-10/+10	-20/+20	-40/+40	-60/+60	-80/+80
Full sample	***	***	***	***		**
Without VEN	***	***	***	*	*	***
Without VEN & ES	***	***	***		***	***

Source: Authors' calculations.

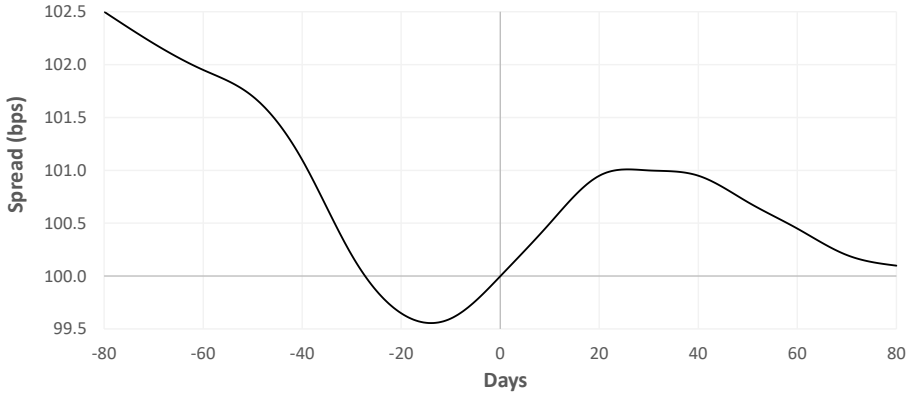

Fig. (2). Smoothed sovereign spreads around corruption scandal announcements.
Source: S&P Global: Market Intelligence.

Mean-comparison analysis for pre- and post-scandal spreads. ***, ** and * correspond to confidence levels of 99%, 95% and 90% for the significance of the mean differences.

Results are significant in showing the difference in means between periods before and after corruption scandals. Confidence levels are robust for all periods except for 40 and 60 days.

We use cubic spline interpolation to smooth results for spread means (with the day of the scandal (Day 0) as base). Fig. (**2**) summarizes results for all countries except Venezuela (which has results inconsistent with all other countries of the studies due to the constant escalation of its sovereign spreads in the observation period).

Sovereign spreads exhibit an overall downward trend over the studied period for all countries except Venezuela. The trend is disturbed by corruption scandals with a strong increase which lasts about 30 days, followed by a steady decline again. An early increasing trend, 15 days before scandals arise, indicates early awareness of the event. Five to ten days before and after the scandal, spreads are stable.

Our dependent variable is daily sovereign spreads from April 2011 to April 2018 (Fig. **3**). We subtract a riskless bond yield (the U.S. 10-year government bond yields) to our risky sovereign bond yields. Ten-year government bonds are generally the most issued types of sovereign bonds, which ensures larger traffic and enhanced sensitivity on the bond's trades. Table **2** shows basic descriptive statistics.

Table 2. Summary Statistics: Sovereign Spreads.

Countries	Min	Max	Mean	Median	Std.dev
Brazil	6.53%	14.76%	9.48%	9.33%	1.67%
Chile	1.22%	3.99%	2.63%	2.52%	0.61%
Colombia	2.7%	7.65%	4.75%	4.62%	0.89%
Mexico	2.6%	5.5%	3.99%	3.91%	0.57%
Peru	1.89%	5.94%	3.67%	3.5%	0.95%
El Salvador	2.78%	8.04%	4.37%	4.16%	0.99%
Venezuela	6.69%	60.06%	17.9%	13.88%	9.36%

Source: Authors' calculations.

Because no such database exists, we assemble 378 scandals of corruption happening between the period Apr-11 and Apr-18 in Brazil, Chile, Colombia, Mexico, Peru, El Salvador and Venezuela.[viii]

Our data depend upon a full-text research among the biggest newspapers of each studied countries. The largest newspapers were identified by readership, at the time, as a percentage of all newspaper readership in the relevant country (International Media and Newspapers, 2018). The dataset considers all scandals framed by the media as being corruption although this includes different types of corruption.[ix] We draw from numerous press sources and select the most trustworthy newspapers to counter the validity problem in newspaper data (Barranco and Wisler 1999). For long-running scandals, each revelation is considered as a single event. The studied variable $SCANDAL_{i,t}$ is a binary variable taking the value 1 if we observed a corruption scandal event for country i and at time t of the observation, and 0 otherwise.

To control for all sovereign spread determinants that are exogenous to corruption scandal events, several control variables are used. Table **3** gathers descriptive statistics for all

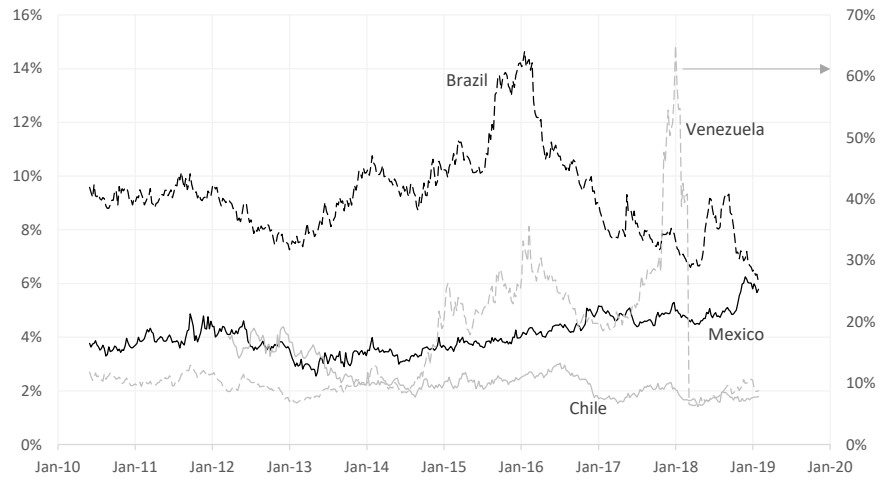

Fig. (3). Four LATAM country 10-year sovereign spreads over US 10-y T-bills from May-10 to Jan-19. Note: Venezuela is plotted on the right-hand axis.
Source: Reuters.

non-binary control variables. We exclude all low-frequency data such as GDP, Public Debt or Current Balance.

Table 3. Descriptive statistics – Control Variables.

Variable	Sources (2018)	Min	Max	Mean	Std.dev
VIX (index value)	CBOE	9.14	48.00	16.19	5.66
U.S. interest rate (%)	Federal Reserve	1.35	3.58	2.21	0.41
Commodity index (index value)	Bloomberg	271.80	760.30	519.70	135.49
Currency (local currency per 1 USD)	Bloomberg	0.93	49420.00	532.20	2162.22
Interbank rates (%)	Federal Reserve	0.00	16.60	3.34	3.04
Momentum (measured over scandal duration)	Own calculations	0.02	23.04	0.80	1.55
Inflation (month-on-month annualised %)	IMF	-0.83	35.08	1.44	3.98
S&P500 (index value)	Bloomberg	1099	2873	1880	419.80

Source: Authors' calculations.

We run a standard linear regression on sovereign spreads and study the coefficient estimators and significance of our studied binary variable, SCANDAL. We then use panel data regression analysis to correct for cross-sectional bias, and dynamic panel regression to study the short-run dynamics of spreads. We acknowledge that our evaluation does not address the magnitude of scandals' economic impact, but rather only the binary qualification of "scandal" versus "no scandal". While we do not believe this omission substantially influences our results, we acknowledge that this limitation deserves further investigation.

Across comparable studies we observe that most employ conventional panel data estimation techniques (Larrain, Reisen and von Maltzan, 1997; Moser 2007; González-Rozada et al., 2008). Anecdotal evidence indicates that the corruption scandal of one studied country could impact the sovereign spreads of the rest of the region (Tegel, 2018). We therefore considered both standard linear regression results and a panel data co-integration procedure.

We estimate our linear regression using (1):

$$SS_{i,t} = \beta_0 + \beta_1 SCANDAL_{i,t} + \beta_2 X_\tau + \beta_3 Y_{i,t} + \beta_4 Z_{i,t} + \varepsilon_{i,t} \quad (1)$$

where β_0 is the intercept, $\varepsilon_{i,t}$ is the error term, $\beta_{1\text{-}4}$ are the coefficients to X, Y and Z which are vectors of variables, respectively controlling for global determinants, country-level variables and bond-specific variables. The subscripts i and t, here and henceforth, represent country and time. We run several regressions altering our dependent variable's functional form.

A positive and significant β_1 is expected based on the direct aftermath of a corruption scandal. Also, we expect β_1 to be larger (or more significant) in poor economic conditions. Finally, the impact of X_τ should be statistically significant.

The global determinants vector X_τ comprises four control variables: VIX (proxy for volatility), U.S. interest rates, commodity prices and the S&P500 index. $Y_{i,t}$ represents country-level determinants and includes three continuous variables (currency, interbank rate, inflation) and one binary variable (natural disasters). $Z_{i,t}$ includes two bond-specific variables (momentum and credit rating downgrades).

We study the contagion effect by adding a contagion-effect variable as in (2), hence verifying our second hypothesis.

$$SS_{i,t} = \beta_0 + \beta_1 SCANDAL_{i,t} + \beta_2 Contagion_{i,t} + \beta_3 X_t + \beta_4 Y_{i,t} + \beta_5 Z_{i,t} + \varepsilon_{i,t} \quad (2)$$

The new variable takes the value 1 when a neighbouring country experiences a corruption scandal, and 0 otherwise. This enables us to estimate the spillover effect that one corruption scandal from country *i* may have on other countries; its significance and its estimated weight. We acknowledge that economic partnerships can arise which are not necessarily fostered by common land borders and often outweigh geographic localisation. Exploring the impact of including non-regional economic partnerships is a possible topic for future exploration.

We calculate several robustness estimators by amending autocorrelation and heteroscedasticity with the Newey-West (1987) correction. Let a general static model with $i = 1,\ldots,N$ and $t = 1,\ldots,T$ depend upon (3).

$$y_{i,t} = \beta_0 + x_{i,t} + z_i + \epsilon_{i,t} \quad (3)$$

with $x_{i,t}$ a K-dimensional vector of independent variables, z_i representing individual characteristics (country-specific factors which do not vary over time), β_0 is the intercept, independent of i and t, and $\epsilon_{i,t}$ is the error term. This general model is like our model, defined in (1). Common issues with this type of model are the autocorrelation across errors and the wrong assumption that errors are iid. Panel Data estimation solves these issues by decomposing $\epsilon_{i,t}$ in (4) with $u_{i,t}$ $\text{iid}(0,\sigma_u^2)$.[x]

$$\epsilon_{i,t} = \alpha_i + u_{i,t} \quad (4)$$

with this decomposition we assemble all country-specific characteristics, those observed with $z_{i,t}$, as well as those that we could not control with our independent variables. These country constant characteristics are summarized in α_i.

A Hausman Test is also performed indicating a preference for FE models (there are several estimation methodologies for FE models). We run a Within estimator and use a Generalized Method of Moments (GMM) technique to investigate the dynamics of sovereign spreads reaction.

The Within estimator technique uses the deviations from the individual means as variables. The model (6) is then subtracted from the original model (7). Resulting estimators therefore account for variations over time among observations and for each specific country.

$$\bar{y}_i = \alpha_i + \bar{x}'_i\beta + \bar{u}_i \quad (6)$$

$$y_{i,t} - \bar{y}_i = (x_{i,t} - \bar{x}_i)'\beta + (u_{i,t} - \bar{u}_i) \quad (7)$$

Note that intercepts disappear from the subtraction. The Within estimator is β's estimator.

The Within estimation assumes: $u_{i,t}$ is assumed to follow a normal distribution, $x_{i,t}$ is strictly exogenous and completely independent from the error terms. This excludes the use of any lagged dependent variables in the model. Of all the within estimator model's limitations, it was the latter that led us towards a GMM method for the inclusion of a lagged dependent variable in our model, necessary to the study of spreads' short-run dynamics.

The Generalized Method of Moments (GMM) is an estimation technique for linear and non-linear models widely used in economics and finance. The GMM method solves this issue by assuming there is a $L \times 1$ vector of instrumental variables $z_{i,t}$ which may contain some or all elements of $x_{i,t}$ as shown in (8). Recall that $x_{i,t}$ is a $K \times 1$ vector of explanatory variables. This new vector is such that $E[z_{i,t}\, u_{i,t}] = 0$ and thus solves the endogeneity issue.

$$E[z_{i,t} y_{i,t}] = E[z_{i,t} x'_{i,t}]\beta \quad (8)$$

The GMM method converts a model into a set of moment conditional that have zero expectation. The GMM estimator is an optimized solution to β such that the zero-expectation condition is respected. Another necessary condition for the correct identification of β is the order condition, which states that ($L \geq K$). Meaning that the number of instrumental variables must be greater or equal to the number of explanatory variables. In our model, we use our lagged independent variables as Instrumental Variables (IV).

We run a System Two-Step GMM (S2S GMM) Estimation. This estimation's model specification is presented in (9).

$$y_{i,t+1} = x_{i,t}\beta + z_{i,t+1} \cdot \beta_i + \varepsilon_{i,t} \quad (9)$$

In (9), the vector $x_{i,t}$ refers to our original set of variables, $z_{i,t+1}$, represents our set of instrumental variables comprising one-day lagged variables of the VIX, US interest rates, commodity prices and the S&P500. Note that we change the dependent variable for a one-day lagged version of itself as part of our objective to study the short-run dynamics of sovereign spreads around corruption scandals.

The S2S GMM estimation runs a first estimation predicting our $x_{i,t}$ vector with our $z_{i,t+1}$ vector (10). In the second stage, it uses the fitted value from Test 1 to predict our $y_{i,t+1}$ values (11). The error term follows a normal law with mean 0 and a constant variance.

$$x_{i,t} = \beta_0 + z_{i,t+1}\beta_i + \varepsilon_{i,t} \quad (10)$$

$$y_{i,t+1} = \hat{x}_{i,t}\beta + \varepsilon_{i,t} \quad (11)$$

We choose to use a system two-step because of the weaker assumptions laid on the endogeneity of instrumental variables but mainly because it allows us to run a robustness test that we consider important for the reliability of our results, i.e. the Windmeijer (2005) correction.

Methodologies diverge when it comes to functional forms in sovereign spreads regression. Prevailing literature shows that most researchers do not justify their choice of using or discarding logarithm transformation. Preferences between using spread levels, logarithms or log differences in sovereign

spreads regression are very seldom discussed in research. The goal of this section is to fill this gap in the literature.[xi]

Six different functional forms are identified: spreads levels, changes in spreads levels, logarithms (log), changes in logs, natural logarithms (ln) and changes in ln. Based on our sample, spreads levels are most widely used and wide deviations can be observed in R^2 scores across research papers.

Higher levels of explanatory powers should however not be the only justification for using one functional form over another. Despite being a useful measure of model quality, R^2 should not drive a model's specification decisions. Academics generally choose methodologies depending on their research objectives. Samaniego-Medina et al. (2016, p.7) hence state that they 'use levels rather than differences in [their] equation because [they] are more interested in explaining the spread than in making predictions'. Annaert et al. (2013), explain that 'by studying (…) spreads changes, [they] filter out any constant (…) specific effects'.

4. RESULTS

4.1. Stage 1: OLS Regression

We use spreads and regress these against our control and studied variables, following Eq. (8). We perform the estimation analysis on several samples, including and excluding Venezuela to palliate the impact of Venezuela's diametrically opposed spreads movements. Model (4) corrects results from Model (2) using the Newey-West correction (1987) with a lag 4. Table **4** presents the results.

Table 4. Regression Results: Dependent Variable: Spreads Levels.

	Scandals only (1)	**Full sample (2)**	**Without Venezuela (3)**	**Newey-West (4)**
ln(VIX)		0.0969	-0.0877*	0.0969
		(1.22)	(-1.67)	(1.21)
ln(U.S. interest rate)		-0.4337***	-0.2981***	-0.4336***
		(-3.97)	(-4.10)	(-4.31)
ln(Commodities)		-3.6040***	-2.5170***	-3.6043***
		(-29.89)	(-31.17)	(-23.80)
ln(Currency)		-0.4784***	-0.4597***	-0.4783***
		(-72.16)	(-103.09)	(-75.27)
Interbank rate		-0.4512***	-0.5394***	-0.4512***
		(-74.13)	(-118.89)	(-53.83)
Momentum		0.9660***	1.8220***	0.9660***
		(62.98)	(48.37)	(14.67)
Inflation		1.0240***	0.6200***	1.0241***
		(168.62)	(18.52)	(74.97)
S&P500		-0.0018***	-0.0011***	-0.0018***
		(-19.57)	(-19.12)	(-17.27)
Credit ratings		-1.6040**	-1.2930***	-1.6041**
		(-2.25)	(-2.97)	(-2.21)
Natural disasters		-0.3596**	-0.1934*	-0.3595***
		(-2.09)	(-1.67)	(-3.31)
SCANDAL	0.3308***	0.5383***	0.3063***	0.5383***
	(5.00)	(4.45)	(3.90)	(4.32)
Constant	6.6521***	33.2500***	25.4300***	33.2492***
	(142.18)	(33.83)	(38.72)	(26.49)
Observations	17 906	17 906	15 348	17 906
Adj. R^2	0.0013	0.8686	0.6750	0.8686

Notes: *t*-statistics in parenthesis. ***, **, * denote 1%, 5% and 10% level of significance.

Source: Authors' calculations.

SCANDAL is statistically significant at the highest confidence levels for all regressions, and its coefficient estimator is always positive. These results provide empirical evidence that corruption scandals are positively correlated with sovereign spreads and negatively correlated with bond holder sentiment in LATAM during the studied period. Also, our intuition regarding the impact of global conditions on sovereign spreads has been demonstrated – though using a small sample spanning only seven years. More work and a larger data sample are required, however, before these results can be considered conclusive. Our main model's explanatory power is strong for standard and robust models (Model 4).

Model (2) presents a higher sensitivity than Model (3) specifically for global-related variables, suggesting a higher elasticity for Venezuelan spreads explained by investor uncertainty and distrust, due to economic instability in the studied period.

Against our expectations, the coefficient on natural disasters is negative, suggesting a decrease in spreads (an improvement in bond holders' views on economic outlooks) following natural disasters events. Interbank rates also return a coefficient sign differing with our expectations. We suspect this might be an error due to the high dynamic divergence across countries and low data quality for some countries. Differences in countries' economies and interbank policies might be at the source of such differences. In stage 2, our panel data analysis corrects this cross-country analysis bias.

Here, we verify the existence of a contagion effect related to corruption scandals. We verify this contagion effect on three different definitions of 'neighbouring countries'.[xii] Specifically, we add a contagion-effect binary variable taking the value 1 if another studied country is involved in a corruption scandal at time t, and 0 otherwise. Results are displayed in Table **5**.

Table 5. Assessing Contagion Effect.

	A - All Region	**B - Impact of Brazil**	**C - Bordering Countries**
Regression (1)	**Studied Variable: Scandal-Contagion**		
Impact estimation	1.425***	1.456***	3.567***
	(6.23)	(5.21)	(12.48)

Adj. R^2	0.0021	0.0014	0.0085
Regression (2)			
Impact estimation	0.069 (0.81)	0.175* (1.71)	0.339*** (3.20)
Adj. R^2	0.8684	0.8684	0.8685
Regression (1)	**Studied variables: scandal and contagion**		
Scandal impact	1.719*** (5.19)	1.673*** (5.05)	2.279*** (6.63)
Contagion impact	1.182*** (3.91)	0.950* (1.90)	6.304*** (12.73)
Adj. R^2	0.0021	0.0014	0.0110
Regression (2)			
Scandal impact	0.515*** (4.25)	0.521*** (4.31)	0.638*** (5.06)
Contagion impact	**-0.310**** (-2.76)	**-0.647***** (-3.53)	**-0.317*** (-1.73)
Adj. R^2	0.8686	0.8686	0.8686

Notes: *t*-statistics in parenthesis. ***, **, * denote 1%, 5% and 10% level of significance. (1) regresses spreads levels as our dependent variable against our studied variable(s). (2) includes all variables used in our first regression (see Table **3**).

Source: Authors' calculations.

When a corruption scandal erupts in a country of the LATAM region, bond holders' sentiment for that country decreases, while increasing for the country's neighbours. Note that the effect has more weight and is more significant for Brazilian scandals. We conclude that during our studied period, a country's misfortune would mean its neighbours' good fortune through the shrinking of their sovereign bonds' yields.

4.2. Stage 2: Panel Data Models

Research articles working with time series across several sections often use panel data estimation procedures. Exceptions include Özatay et al. (p.527, 2009) who justify their methodology choice as follows: "The literature often employs conventional panel data estimation procedures which do not allow for cross-section dependence. However, omitted common variables or global shocks such as contagion may induce cross-section dependence and lead to inconsistent regression coefficient estimates if they are correlated with the explanatory variables." This encouraged us to perform both standard regressions (to assume and assess the existence of a contagion effect) and a panel data estimation (to correct our analysis for country-specific and time-specific effects). We run the FE 'Within' estimation one-way and two-way and set a dynamic panel model to study the short-run dynamics of sovereign spreads' reactions to sovereign spreads with a System Two-Step Generalized Method of Moments (S2S GMM).

We proceed with a standard panel data regression, on a one-way and then two-ways 'within' model.[xiii] We run the regression on scandals only and then add our pool of control variables. Outputs are summarized in Table 6. F-tests comparing performance between FE and OLS models are superior over the FE model using regular linear regressions.

Table 6. Panel data regression. Note that estimates from two-ways specification models are substantively difficult to interpret because they are a complex amalgamation of variation in the over-time and cross-sectional effects.

	Scandals Only (1)	**One-Way (2)**	**Two-Ways (3)**
ln(VIX)		0.1533** (2.46)	
ln(U.S. interest rate)		-0.4182*** (-4.93)	
Commodities		-0.0801*** (-39.33)	
Currency		0.0000*** (3.93)	
Interbank rate		0.0933*** (10.84)	0.0972*** (10.90)
Momentum		0.8879*** (74.46)	0.8927*** (71.42)
Inflation		0.8229*** (131.41)	0.8434*** (144.12)
S&P500		-0.0172*** (-22.13)	
Natural disasters		-0.2420* (-1.85)	
SCANDAL	1.0714*** (5.47)	0.2226** (2.43)	0.3519*** (3.57)
Observations	17 906	17 906	17 906
Adj. R^2	0.0012	0.7835	0.7397

Notes: *t*-statistics in parenthesis. ***, **, * denote 1%, 5% and 10% level of significance.

Source: Authors' calculations.

After controlling for individual specific effects (2) as well as individual and time-specific effects (3), our studied variable continues to return highly significant positive coefficients. Controlling for country and time-specific effects does remove a part of the weight of scandals on sovereign spreads. We recognize that results from stage 1 wrongfully accounted for some unspecified constant and country-specific effects that are now extracted in this panel data regression. We can now estimate the impact of corruption scandals on daily spreads to amount to 22 basis points (bps) when controlling

for entity effect only, and to 35bps when we control for both time and entity effects.

We add that all coefficient signs remain coherent; also, country differences in interbank rates have been corrected, as the coefficient sign now displays a positive sign, which is more consistent with our expectations.

4.3. Recession Impact

This section aims at verifying a recession impact hence confirming results found by Pastor and Veronesi (2011). For this we create a new explanatory binary variable which will be our recession, i.e., a weak economy indicator.[xiv] We identify recession quarters for all countries through their quarterly GDP growth results[xv] as well as an approach suggested by Hamilton (1989). Two countries experience prolonged recessions in LATAM during our timeframe: Brazil and Venezuela.

We conduct this analysis with a Panel Data model rather than a standard regression because we argue that a recession variable works with strong country-specific effects, so these are better controlled with a panel data estimation technique. Outputs are displayed in Table **7**.

Table 7: Panel Data Estimation with a Recession Variable.

	(1)	(2)	Comparing (1) and (2)
ln(VIX)	0.1533**	0.1516**	*
	(2.46)	(2.44)	
ln(U.S. interest rate)	-0.4182***	-0.4281***	*
	(-4.93)	(-5.05)	
Commodities	-0.0801***	-0.0769***	*
	(-39.33)	(-37.13)	
Currency	0.0000***	0.0000***	**
	(3.93)	(4.31)	
Interbank rate	0.0933***	0.0892***	*
	(10.84)	(10.38)	
Momentum	0.8879***	0.8924***	
	(74.46)	(74.87)	
Inflation	0.8229***	0.8103***	*
	(131.41)	(125.51)	
S&P500	-0.0172***	-0.0166***	*
	(-22.13)	(-21.36)	
Natural disasters	-0.2420*	-0.2683**	***
	(-1.85)	(-2.06)	
Recession		0.4519***	
		(7.81)	
SCANDAL	0.2226**	0.1924**	***
	(2.43)	(2.10)	
Observations	17 906	17906	
Adj. R^2	0.7835	0.7842	

Notes: *t*-statistics in parenthesis. ***, **, * denote 1%, 5% and 10% level of significance. (1) refers to previous results from Table **5**; (2) refers to our new results when including the Recession variable. In the Comparing column, we explore the percentage change of variables' estimators and classify them from most impacted to least impacted variable by the addition of the Recession variable. ***, **, * denote 10%, 5% and 1% changes in estimators.
Source: Authors' calculations.

The statistical significance of our recession binary variable, and its positive sign concords with our expectations. The most impacted variable from the inclusion of a recession variable is SCANDAL: its estimator declines by 13% when we add the recession variable. This indicates that when recession is not considered, the impact of scandals is heavier. Thus, for a country suffering from recession, the aftermaths of corruption scandals on sovereign spreads are stronger. The increase in the spread's shock would amount to approximately 0.0300 (0.2226 – 0.1924) so for a country in recession, the impact of corruption scandals on sovereign spreads is inflated by 3bps. Natural disasters also bear heavier weight on sovereign spreads in times of recession, their impact increases by 2bps.

We thus validate our first hypothesis and confirm Pastor and Veronesi's (2011) findings.

4.4. Dynamic Panel Data Model

We use a system generalised method of moments (GMM) estimation for dynamic models with panel data.[xvi] Our analysis uses GMM with an instrumental variables (IV) estimation. This test aims at correcting the endogeneity issue among global factors, while including the short-run dynamics of sovereign spreads. IV estimation is useful when some explanatory variables are correlated with the error term. This can be due to an omitted variable, which we suspect may have happened in our model due to the data frequency restriction.[xvii]

4.5. System Two-Step GMM (S2S GMM)

We identify all global-related variables as endogenous, and their respective one-day-lagged variables as instruments, we replace our DV by one-day-lagged spreads. Results are displayed in Table **8**.

Table 8. Two-steps System GMM.

	(1)	(2)
ln(VIX)	1.9332***	2.0791***
	(30.74)	(30.75)
ln(U.S. interest rate)	-2.1517***	-1.2723***
	(-21.59)	(-13.43)
ln(Commodities)	0.2823***	0.0522
	(8.04)	(1.50)

ln(Currency)	-0.4774*** (-70.11)	-0.4666*** (-70.72)
Interbank rate	-0.4478*** (-71.63)	-0.4368*** (-52.20)
Momentum	0.9503*** (60.36)	0.9628*** (14.00)
Inflation	1.0245*** (164.21)	1.0173*** (77.11)
S&P500	0.0010*** (26.58)	0.0012*** (32.61)
Natural disasters	-0.3880** (-2.20)	-0.2766** (-2.39)
Credit Ratings	-1.6823** (-2.30)	-1.6275** (-2.01)
SCANDAL	0.6753*** (5.44)	0.6508*** (5.16)
Observations	17 905	17 905
Adj. R^2	0.9358	0.9354

Notes: *t*-statistics in parenthesis. ***, **, * denote 1%, 5% and 10% level of significance. Endogenous variables are ln(VIX), ln(U.S.int), ln(commodities) and S&P500. Instruments are lagged VIX, U.S. interest rates, lagged commodities and lagged S&P500. (1) runs the system GMM estimation, (2) corrects it with the Windmeijer correction.
Source: Authors' calculations.

Windmeijer (2005) notes a severe downward bias in GMM standard errors typically in studies with small samples and proposes a correction. Statisticians strongly encourage studies to perform this robustness test, for a better precision of the two-step estimators. This bias emerges specifically in two-steps system GMM estimations, because 'one-step GMM estimators use weight matrices that are independent of estimated parameters, whereas the efficient two-step GMM estimator weighs the moment conditions by a consistent estimate of their covariance matrix' (Windmeijer, 2005, p.26). Table 8 displays our two-steps system GMM estimation outputs with (1) and without (2) the Windmeijer correction.

We note that with spreads $t + 1$, the scandal effect almost doubles its impact from 35bps to 65bps. The explanatory power of our model after incorporating global dynamics and the lagged DV increases substantially.

5. CONCLUSIONS AND SUGGESTION FOR FUTURE WORK

Corruption and its economic implications have attracted much attention among economics and finance researchers. Corruption impacts economic development by diminishing economic efficiency and growth and it reduces the equitable distribution of resources among affected populations. This increases income inequality and lowers human development by undermining the efficacy of social welfare programmes. The outcome is diminished long-term sustainable development, equality and economic growth. In this study, we exploit a proliferation of corruption scandals in LATAM to study the mechanisms through which exogenous shocks may impact sovereign spreads. Our initial idea was that corruption scandals would increase political uncertainty which would in turn inflate the countries' sovereign spreads, and our quantitative findings confirm this viewpoint. We highlighted the escalating erosion of trust from international bond holders as the swelling effect of corruption scandals over sovereign yields increases in strength and significance over time.

Corruption reduces sovereign bonds creditworthiness by diverting loan proceeds from productive projects to less productive ones, and often to offshore accounts. We contribute to the existing literature on the impacts of corruption by studying specific corruption scandal cases. We document the determinants and dynamics of sovereign spreads and validate previous findings. Our study has some useful implications for inter-national bond holders and for LATAM policymakers. Through a better understanding of sovereign yields' dynamics and reactional mechanisms to corruption scandals, bond holders can optimize their returns by adjusting their investment strategies. Policymakers can also use our results to predict their country's cost of debt and modify their fiscal strategies accordingly.

Our estimation showed that international bond holders react negatively to corruption scandals, on the day of their announcement, and even more on the following day. This reaction has been estimated onto sovereign spreads and amounts to +35bps on the day of the scandal, and +65bps on the following day. The strength and significance of this impact is larger for countries that have most been affected by corruption scandals (Brazil, Peru, Colombia, Mexico). Also, this spreads' reaction-to-scandals mechanism is stronger from year 2015 until 2018; namely, the years following Operation Car Wash which can be considered as the initiator to LATAM's corruption scandal boom. Weaker economic conditions are also known to strengthen this spreads-inflating impact as well.

Corruption scandals in one country positively impact neighbouring countries (through a sovereign yield deflation), possibly due to the reallocation of funds by international investing institutions from one country to another. Neighbouring countries' spreads can decrease by -62bps; the decrease is larger when the scandal happens in Brazil.

Markets react negatively to corruption scandals; even though these scandals help to dismantle large corruption schemes, they serve as a reminder for investors of the severity of the country's public corruption situation, and as a provoker of political uncertainty. We do not exclude the possibility of an overall positive effect of this period for LATAM's economic stability in the long-term. These scandals may lead to a considerable shrinking of public corruption in the region and free LATAM from the corruption plight that was crippling its economic development.

Future research may verify the long-term impact of anti-corruption policies and resulting corruption scandals on sovereign spreads. It would also be interesting to explore investors' mindset: as corruption scandals emerge, are outside

investors reassured by these symptoms of helpful anti-corruption policies, or do they perceive scandals to be evidence for deep and hopeless systemic problems? Our scandal dataset can be used for a wide variety of research problems. Studies could be conducted at the firm or country-level on the impacts of corruption by comparing the before and after of each corruption scandals, similarly to Fan et al. (2008) and Pan and Tian (2017). Our findings on the strong inverse contagion effect of corruption scandals also deserves some further research. Overall, researchers could take advantage of this unique period of corruption scandal proliferation in LATAM to study a large panel of subject matters related to finance and economics.

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This disclosure acknowledges that there are no financial interests or benefits that arose from the direct application of our research.

ENDNOTES

1. Political risk is the possibility that political decisions or political and social events in a country will affect the business climate in such a way that investors will lose money (Howell 2001). Political uncertainty is the unpredictability of changes in existing policies and laws.
2. Bekaert et al. (2015) argue that this is because international firms use sovereign spreads as discount factors to compute the Net Present Values (NPV) of their international projects, spreads that are inflated in times of political unrest.
3. Literature has repeatedly shown the high correlation between sovereign credit ratings and their respective yields (Cantor and Packer, 1996). There is a large announcement effect from credit ratings agencies on the bond-market, especially in the event of downgrades (Larrain, Reinen and von Maltzan 1997).
4. Research on corruption is not easy and suffers from various flaws and biases. Exempting the unclear definition of corruption and poor distinction between corruption types that have already been mentioned, the main defect of corruption-related research, is the difficulty in measuring corruption. Indeed, because of its clandestine and multi-faceted nature, corruption usually leaves no trails, making the assessment of corruption levels an inevitable challenge. This issue has led economists with little choice but to rely on subjective surveys and biased perception indicators to conduct their research (Cai et al. 2011). The CPI (Corruption Perception Index) is the most frequently used indicator for corruption, although it has often been criticized as being subject to several biases (Bertrand and Mullainathan 2001; Depken, Lafountain and Butters 2006).
5. Lack of available data for several Latin American countries forced us to remove them from this study. Ssovereign yields data are scarce for a large part of the region. Also, some countries' default history and estranged relations with global debt markets have had a damaging impact on the quality of their sovereign yields data. Note that a similar study conducted in a different world region would probably not have yielded the same results. Bondholders' attention attracted by LATAM with its Scandal Boom was unique to the period and to the region. This empirical analysis focuses on a period of political turmoil in LATAM related to corruption scandals; we suspect that out of context, a scandal's impact on a country's debt market would not be as significant as what was found here.
6. The sources for this research are Bloomberg, Central Banks' official websites and the World Bank database.
7. Non-normality of sovereign spreads is confirmed through an adjusted Jarque-Bera test.
8. One interesting note is the difference between Venezuela and the other studied countries. Contrary to its neighbours, the Venezuelan government does not appear as a public enemy of corruption. As a result, there are no notable independent organization working on dismantling corruption schemes. This reflects on the scandals' sources: most scandals come from foreign newspapers releasing their results on an ongoing corruption investigation featuring Venezuela. Also, the historic highs of Venezuelan spreads during the studied period, and their almost uninterrupted increasing trend produces drastic differences in results with the other studied countries.
9. Corruption types include: embezzlement, bribery, fraud, extortion, price agreements and money laundering. We identified and assigned the label "corruption scandal" to relevant events using the research from Transpar-ency International (2018).
10. We assume u has mean $= 0$, is homoscedastic and not serially correlated.
11. Although a review of the different methodologies in sovereign spreads regression deviates from the scope of this paper, our intention is to summarize functional forms used in literature, the range of their resulting explanatory powers, as well as their advantages and disadvantages.
12. Model A investigates the impact of contagion on the entire LATAM region. Model B focuses on the impact of Brazil on the rest of the region. Brazil has been a key player in the emergence of corruption scandal throughout LATAM. Its *Car Wash* operation has induced a proliferation of corruption scandals in LATAM resulting in political crises in several of our studied countries. See Pacheco (2017). Model C assesses the contagion effect for countries sharing a border.

13. One-way models do not include time effects contrary to two-way models.
14. The variable displays 1 in times of recession and 0 otherwise. We define a recession as a period in which the two preceding quarters present negative GDP growth.
15. For Venezuela, the absence of GDP data from 2015 makes us unable to generate a recession indicator for years 2016, 2017 and 2018. Also, previous years' data are extracted from the Venezuelan Central Bank's website, which could be considered a compromised source of data. To complete our recession dummy variable, we assume all quarters from Q4-2015 until Q1-2018 to be recession quarters. Our assumption is backed by the IMF's annual GDP growth estimations for Venezuela which have been consistently negative these past few years (2016: -10%; 2017: -12%, 2018: -15%); (IMF WEO 2016, 2017, 2018). With a cumulative GDP decline of nearly -50% since 2013 in Venezuela, we feel that our assumption, that all quarters (since 2015) can be defined as recession quarters, is sensible.
16. We also identified recession periods using real GDP growth rates, subject to autocorrelated discrete shifts. The technique pioneered by Hamilton (1989) shows that the business cycle is better characterised by a recurrent pattern of such discrete shifts between a recessionary state and a growth state rather than by positive coefficients at low lags in more-commonly used autoregressive models.
17. We recognize that this type of estimation best suits small T - large N contexts. However, we feel a two-step system GMM is the most relevant dynamic model we can use with our data. Because other models such as autoregressive processes serve a predictive purpose while GMM is used for estimating parameters. GMM allows potential inconsistencies in assumptions (such as the normality of error terms) and is widely applicable, although sometimes deemed 'questionable' for small samples (Sheppard, 2013).
18. Despite our efforts to include all relevant variables, we were forced to remove some due to differences in data frequency. With our dependent variable, we used daily variables.

CONFLICTS OF INTEREST

The authors assert no conflicts of interest.

AUTHOR CONTRIBUTIONS

Author	Responsibility
1	Conceptualisation, design, principal analysis, and initial draft assembly.
2 (corresponding)	Supervision of research, calculations, and assistance with interpretation of results, visualisation and proofreading.

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