

Effects of corruption on stock markets in the 2008 Financial Crisis

Efeitos da corrupção nas bolsas de valores na Crise Financeira de 2008

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Palavras-chave

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Abstract

This article aimed to determine if the different levels of corruption reflected in the behavior of stock exchanges around the world in the 2008 Financial Crisis. The Institutional Choice Theory indicates that, in the period before the Crisis, financial practices that provided large gains and concealed high risk were widespread. Information from Transparency International and World Bank on perceived corruption and governance level was used for a final sample of 56 (fifty-six) countries. The main stock exchange and its main index was identified for these countries as well as their main stock exchange index, whose daily quotations at the end of the trading day were surveyed for the period 2007-2009. The main results show that in countries with greater perceived corruption and lower governance, the 2008 Financial Crisis led to a greater cumulative stock market decline, followed by a deeper structural break, increased volatility and lower predictability of the fall. The article concludes that, in general, the effects of the 2008 Financial Crisis differed according to the level of perceived corruption and governance, being more severe in countries where corruption was more institutionalized.

Resumo

O objetivo deste artigo é averiguar se os níveis diferenciados de corrupção se refletiram no comportamento das bolsas de valores ao redor do Mundo na Crise Financeira de 2008. A Teoria da Escolha Institucional indica que se generalizaram práticas financeiras proporcionadoras de grandes ganhos, as quais escondiam elevado risco, no período anterior à Crise. Foram utilizadas informações da Transparency International e do Banco Mundial sobre a corrupção percebida e o nível de governança para uma amostra final de 56 (cinquenta e seis) países. Para esses países, foi identificada a principal bolsa de valores e, para cada uma, o principal índice de bolsa, cujas cotações diárias de final de pregão foram levantadas para o período de 2007 a 2009. Os principais resultados evidenciam que em países com maior corrupção percebida e menor governança a Crise Financeira de 2008 acarretou maior queda acumulada das bolsas de valores, seguida de quebra estrutural mais profunda, aumento da volatilidade e menor previsibilidade da queda. Conclui-se que, de modo geral, os efeitos da Crise Financeira de 2008 foram diferenciados conforme o nível de corrupção percebida e de governança, sendo mais graves nos países em que a corrupção se apresentava mais institucionalizada.

Practical implications

The findings support financing and investment decisions in countries considering the level of perceived corruption as well as the choice of buying or selling assets in crisis scenarios. Even though this article offers no metrics, it provides a useful indication of the behavior of stock exchanges in times of crisis.

1 INTRODUCTION

The huge stock market declines of 1929, 1987 and 2008 are phenomena associated with the lack of regulation, adverse framework and exaggerated expansion in the immediate period preceding the crash. However, the break of expectations due to a loss of confidence in the market's ability to maintain or regain equilibrium is common to all of them. With the loss of confidence, agents withdraw and suspend their operations and the crisis deepens.

The stock market, like the securities market in general, consists of a set of rules about the trading under the price system and is essentially differentiated from the others. This market readily responds to agents' perceptions, especially analysts and investors, and is a prime signal of the economic environment, as their prices are directly influenced by the level of confidence.

Transparency International annually releases the Corruption Perception Index (CPI), which indicates the level of perceived corruption in 180 (one hundred and eighty) countries. The World Bank publishes the Worldwide Governance Indicators (WGI) in 200 (two hundred) countries and represents the level of governance of countries around the world. These indices can be used as thermometers for the level of economic, financial and social uncertainty of the countries, that is, they represent the level of confidence in the institutions. Confidence in institutions is eroded by corruption. As for the market, the economic effect of corruption is premised on its imperfections, such as information asymmetry and uncertainty (Jain, Kuvet & Pagano 2017).

Previous studies have highlighted the relationship between corruption and institutional elements, understanding corruption as present in and determined by institutions (Glaser & Saks, 2006; Dong & Torgler, 2013; Dong, Dulleck & Torgler, 2012; Lee & Guven, 2013; Dzhumashev, 2014, Mironov, 2015; Smith, 2016; Ortiz-Ospina & Roser, 2016; Salmon & Serra, 2017), as well as the relationship between corruption and financial crises (Kaufmann, 2009; Ivlevs & Hinks, 2013; Gugiu & Gugiu, 2016).

According to Institutional Choice Theory, institutions are formed by rules or sets of political, economic and cultural rules that mediate the relationship between the individual (agent) and the structure (society) (Collier, 2002). From this perspective, the external world constitutes the institutional structure and influences the inner world of agents. That is, agents' choices are limited and conditioned by the institutions. Corruption, from this perspective, is a choice of the agent and, as corruption is more present in institutions, the institutional choice of corruption becomes more common.

In times of crisis, there is a loss of confidence in institutions and markets become more vulnerable (Corsett, Pasenti & Roubini, 1999; Morales & Andreosso-O'callaghan, 2012). In markets where corruption is more institutionalized, the loss of confidence becomes greater due to ineffective mechanisms to end and control corruption, abuse of political power for private interests, bribery, embezzlement, nepotism, ineffectiveness of government, low regulatory quality, among others.

Given this, the following research question is proposed: Have the effects of the 2008 financial crisis on stock markets around the world been differentiated according to the level of corruption in countries?

This article seeks to contribute to the literature on corruption by using the Institutional Choice Theory to analyze it, since several publications on corruption have no theoretical support (Judge, McNatt & Xu, 2011). A second contribution lies in relating corruption to the financial market (Jain, Kuvvet & Pagano, 2017; Paserman, 2017), by admitting that financial market agents perceive the social context in which they operate, and their decisions are influenced by the institutional framework. A third contribution concerns the responses markets give to external events.

Contaminated by the 2008 Financial Crisis, world markets fell sharply and became more volatile. However, markets were affected differently, and this article aims to relate the effects in each market to the perception of corruption. Finally, this study also expects to contribute to the literature on investment decisions in markets with institutionalized corruption, as previous studies have shown that corruption influences companies' leveraging and cash availability (Smith, 2016).

2 INSTITUTIONAL CHOICE

The Institutional Choice Theory was developed by Collier (2002), who adopted an interdisciplinary approach to the causes of corruption. The model developed by Collier (2002) states that individual choice is limited by social institutions. For the author, institutions are formed by rules or set of political, economic and cultural rules that mediate the relationship between the individual (agent) and the structure (society).

Rules make people socially active, form the agent-structure relationship, and give society a recognizable pattern or structure. Any change in the rules of a society redefines the agents, institutions and their relationships with each other (Onuf, 1994 apud Collier, 2002). That is, agents and society co-constitute each other in a continuous process (Onuf, 1997 apud Collier, 2002). According to this theoretical perspective, the world is socially structured by social rules, that is, by institutions (Collier, 2002).

Judge, McNatt and Xu (2011) have adapted the model developed by Collier (2002) and point to corruption as an institutional choice. According to the model, the external world constitutes the institutional structure (rules) that influences the agent's internal world in decision making. It is in the outside world that there are the material resources that affect agents as to the expected benefits and costs. This model is circular, corrupt behavior affects the structure and internalized rules of agents, representing feedback. From this perspective, corruption is understood as obtaining legal or illegal private advantages arising from the use of power, whether public or private (Collier, 2002; Judge, McNatt & Xu, 2011; Ortiz-Ospina & Roser, 2016). For Judge, McNatt and Xu (2011), corruption occurs in organizations due to behaviors consolidated and shared by its members. As corruption becomes common and widespread, the expected cost of punishment becomes lower due to the low possibility of detection and punishment (Dong, Dulleck & Torgler, 2012).

The 2008 Financial Crisis was an unforeseen and worldwide economic event that, beginning in the U.S. market and quickly spreading to other markets and shaking the confidence in organizations (Samarakoon, 2011; Morales & Andreosso-O'callaghan, 2012; Kenourgios & Dimitriou, 2015; Clemente, Juaniha & Ribeiro, 2018). The origin of the crisis is not only associated with increased lending to sub-prime borrowers but also with the network of connections of the financial market, dispersion of financial system risk and loss of confidence in the financial architecture (Smick, 2009; Paulson Júnior, 2010; Shiller, 2012; Irwin, 2014).

Chart 1 presents the main events disclosed to the market, concentrated in the second half of 2008 (Bacen, 2008).

Date	Event
10/01/2008	U.S. Senate approves US\$ 700 billion bailouts
10/03/2008	U.S. House of Representatives approves package to contain crisis, value reaches US\$ 700 billion
10/06/2008	Stock markets collapse worldwide; Moscow stock market drops 19%
10/07/2008	The worst of the crisis is to come, according to the International Monetary Fund (IMF). Confidence must be restored in the financial sector
10/13/2008	Federal Reserve, European Central Bank, Bank of England and Swiss National Bank announce measures to bail out banks and increase market liquidity
10/15/2008	Worst Wall Street auction since 1987 Increase in US bank lending along with FRS, average of US\$ 437 billion
10/16/2008	British government bailout through Bank of England Swiss National Bank helps Union Bank of Switzerland with US\$ 5.2 billion and Credit Suisse raised 10 billion Swiss francs from Arab funds ECB accepts assets of higher risk as collateral for bank loans
10/17/2008	Central Bank issues rules for foreign currency lending as collateral Due to large losses on derivatives, Brazil's Securities and Exchange Commission (CVM) requires details from the third quarter on the financial instruments used.
10/24/2008	Asian stocks close sharply, Tokyo fell 9.6%
10/27/2008	Hong Kong stock exchange has biggest fall since 1987

Chart 1. Events Related to the 2008 Financial Crisis

At the heart of the Crisis was the loss of confidence in financial architecture (Smick, 2009) and, as a result, markets became more vulnerable (Morales & Andreosso-O'Callaghan, 2012). The stability of financial institutions depends on the trust of market participants, as well as on economic relations (Smick, 2009; Paulson Junior, 2010).

In this situation, from the perspective of the Institutional Choice Theory, financial market agents incorporated practices that, according to Smick (2009, p. 292), were “‘risk-free risk’ with the added benefit of huge profits”. To the extent that these practices were being adopted for private benefit without due precaution regarding risks, the agents’ corrupt attitudes were legitimated. The yields were increasingly high and market regulators became complacent about the risks taken by agents (Paulson Junior, 2010).

According to Transparency International (2012), the crisis in Greece was related to corruption, which cost about € 554 million in 2011. Gugiu and Gugiu (2016) found a positive relationship between the economic crisis of the European Union and the perception of corruption. Kaufmann (2009) points out that among the various causes of the financial crisis, corruption is one of the most important causes. Ivlevs and Hinks (2013) found a relationship between the effects of the 2008 Financial Crisis and corruption in 30 transition economies. For the authors, the Crisis contributed to the increase in bribery, meaning that individuals most affected by the Financial Crisis were more likely to engage in corrupt transactions. This is because crisis victims are “easier” bribery targets (Ivlevs & Hinks, 2013).

Based on the researched literature, our general hypothesis is that the stock exchanges of countries with the highest level of perceived corruption were most affected by the 2008 Financial Crisis. To operationalize this general hypothesis, the following hypotheses are stated:

H₁: In the 2008 Financial Crisis, countries with the highest perceived corruption had the largest cumulative drop between the auction with highest drop and the following one.

H₂: The rise in stock market volatility caused by the contagion of the 2008 Financial Crisis was higher in countries with the highest perception of corruption.

H₃: The predictability of stock market declines in the 2008 Financial Crisis was lower in countries with the highest level of perceived corruption.

H₄: The 2008 Financial Crisis represented a more evident structural break in countries where perceptions of corruption were highest.

H₅: The difference between the dates of the highest drop and that of the structural break was greater in countries with the lowest perceived corruption rate.

3 METHODOLOGY

The universe of this study comprises the countries for which the CPI is available. This index covers 180 (one hundred and eighty) countries and is published by Transparency International, being presented on a scale from 0 to 100, in which 0 represents highly corrupt and 100 free from corruption (Paldam, 2002; Transparency International, 2018). According to Transparency International (2018), CPI captures numerous aspects of corruption related to bribery, lack of punishment mechanisms, appropriate financial disclosure laws, among others. The CPI is advantageous for being available for an extended period, for the number of countries surveyed and also for reflecting the perception of financial market participants (Paserman, 2017).

The WGI was also used, which comprises six dimensions: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption (Kaufmann, Kraay & Mastruzzi, 2011). A major component proved adequate to summarize the information contained therein.

We used CPI and WGI as corruption level proxies. This is based on the idea that in countries with more institutionalized corruption there is a higher perception of corruption and a lower score on the governance indicator. In this sense, the lower the CPI and the lower the WGI, the more institutionalized corruption is in a certain country.

Then, the main stock exchange of each country and the main representative index of the market were identified. As a result, each country was associated to a stock exchange index and we could survey the trading session closing prices from January 2007 to December 2009 (Righi & Cereta, 2013; Paserman, 2017). For the dates without trading, the closing price of the previous trading day was used. We calculated the daily return by the ratio between the range between successive prices and the starting price.

We chose this period because the 2008 Financial Crisis began in the North American market in 2007 and lasted until approximately March 2009 (Samarakoon, 2011; Kobayashi, Nakajima & Inaba, 2012; Boubarker, Jouini & Lahiani, 2016). In addition, taking the North American market as a reference is justified because it was the epicenter of the Crisis that spread to financial markets around the world (Ffrench-Davis, 2010; Luchtenberg & Vu, 2015; Boubaker, Jouini & Lahiani, 2016).

3.1 Hypotheses and methodological procedures

For hypotheses H2 and H3, analysis was performed from 60-trading windows before and after the highest drop (MacKinlay, 1997; Campbell, Lo & MacKinlay, 1997).

For hypotheses H4 and H5, the window used was from 01/01/2007 to 31/12/2009 to verify the existence of structural change (Gujarati, & Porter, 2011; Shikida, Paiva & Araújo Júnior, 2016). Chow and Quandt or sup-Wald tests were used. Chart 2 presents the definition of the variables.

Variables	Definition	Symbol	Operationalization
Corruption	Corruption Perceptions Index	CPI	Transparency International Index
World Governance	Worldwide Governance Indicators	WGI	World Bank Index
Biggest drop	Stronger negative return	Drop	$R_{it} = \ln(P_t/P_{t-1})$
Accumulated drop	Stronger negative return accumulated with the next trading day	Q_accum	$R_{it} = \ln(P_{t-1}/P_{t+1})$
Volatility	Volatility in window of 60 trading sessions before the biggest drop and 60 after	DIF_SD; RAT_SD	Difference and Standard Deviation Ratio in the estimation and comparison windows
		DIF_VAR; RAT_VAR	Difference and Ratio of Variance in estimation and comparison windows
Difference between drop forecast and actual drop	Difference between predicted return and calculated return for the day of the biggest drop	Dif	$(Y_{estimated}_{it}) = a + B_{it}$ $Dif = (Y_{estimated}_{it}) - Y_{it}$
Structural break	Change in level, dispersion, time series slope	Qe	F Statistics of Quandt Test and Chow Test
Drop forecast	Difference between the date of the trading session with biggest drop and the date of the structural break	Dif_dates	Correlation between the difference of the date of the trading session with biggest drop and the date of the structural break

Chart 2. Definition of variables

The formulated hypotheses, their variables and tests are in Chart 3.

Hypothesis	Variables	Statistical test	Expected signal
H ₁	Q_accum; CPI; WGI	Correlation	(+)
H ₂	DIF_N; DIF_N1; DIF_SD; RAT_SD; DIF_VAR; RAT_VAR; CPI; WGI	Correlation	(-)
H ₃	Dif; CPI; WGI	Correlation	(-)
H ₄	Qe; CPI; WGI	Correlation	(+)
H ₅	Dif_dates; CPI; WGI	Correlation	(+)

Chart 3. Variables and statistical tests

3.2 Sample

For each country, the main stock exchange was identified, and its main index was searched. Then, the daily closing prices of each index were collected. This enabled the calculation of the daily return. The countries that presented the biggest drop in the third quarter of 2008 were selected, totaling 56, according to the Chart 4.

Countries	Amount
Countries listen in the CPI in 2008	180
With missing data	(98)
Biggest drop did not occur in the third quarter of 2008	(26)
Sample	56

Chart 4. Sample

4 RESULTS

As shown by Table 1, among the countries selected in the sample, the first major drop due to the Crisis occurred on 09/15/2008 in Ukraine and the last on 12/01/2008 in Canada. Of the total sample, 21.42% of drops are concentrated on 10/06/2008. According to Chart 1, this date was of great volatility and sharp drops in several countries.

The biggest drop recorded in the entire sample occurred in Russia, on the same trading day of 10/06/2008, equal to 20.7%, and the smallest drop was observed in Malta, on 18/09/2008, with negative variation of 4%. The United States, which was the epicenter of the 2008 Financial Crisis, dropped by 8% on 10/15/2008. On the same date, Brazil had a drop of 12%, Hungary 13% and Argentina, also 13%. This trading day of 10/15/2008 has been recognized as the worst on Wall Street since 1987 (Chart 1).

The highest volatility around the largest drop was also observed in Russia, while the lowest volatility occurred in Malta. Thus, the market with the biggest drop also had the highest volatility and the market with the smallest drop was also the one with the lowest volatility in its surroundings.

The Principal Component Analysis (PCA) extracted a component representing 85.83% of the variance observed in the variables that compose the WGI. The Kaiser-Meyer-Olkin (KMO) value reached 0.917, indicating a high PCA adequacy level.

Table 1. Research variables and descriptive statistics

Country	Index	Date (2008)	CPI	WGI	Drop (%)	Q_accum (%)*	Vol_SD -60/+60**	Vol_VAR -60/+60**
Ukraine	UAX	15/Sept.	2.5	-0.5	13.2	24.5	.0289 /.0481	.0001 /.0023
Malta	MSE	18/Sept.	5.8	1.39	3.5	1.8	.0081/.0075	.0001/.0001
Luxembourg	LUXX	29/Sept.	8.3	1.85	11.2	7.9	.0214/.0370	.0005/.0014
Ireland	ISEQ	29/Sept	7.7	1.74	14	6.4	.0355/.0392	.0001/.0015
Belgium	BFX	29/Sept	7.3	1.38	8.3	5.2	.0233/.0345	.0001/.0012
Denmark	OMXN40	06/Oct.	9.3	2.05	8.7	9.7	.0231/.0392	.0001/.0015
Sweden	OMXS30	06/Oct.	9.3	1.92	7.5	9.8	.0234/.0381	.0006/.0014
Finland	OMXH25	06/Oct.	9	1.99	8.9	12.1	.0234/.0344	.0006/.0012
Netherlands	AEX	06/Oct.	8.9	1.79	9.6	10.6	.0240/.0414	.0006/.0017
France	FCHI	06/Oct.	6.9	1.41	9.5	8.9	.0217/.0396	.0005/.0016
Chile	SPCLXIPSA	06/Oct.	6.9	1.27	6.2	10.6	.0158/.0259	.0003/.0007
Portugal	PSI20	06/Oct.	6.1	1.18	10.4	11.6	.0194/.0289	.0004/.0008
South Africa	JTOPI	06/Oct.	4.9	0.35	8	5.1	.0239/.0362	.0006/.0013
Italy	FTMIB	06/Oct.	4.8	0.64	8.6	9.2	.0200/.0384	.0004/.0015
Lithuania	OMXVGI	06/Oct.	4.6	0.76	9.1	17.4	.0156/.0331	.0002/.0011
Peru	XU100	06/Oct.	4.6	0.01	9	9.1	.0280/.0350	.0008/.0012
Russia	IMOEX	06/Oct.	2.1	-0.8	20.7	21.6	.0517/.0655	.0037/.0043
Jordan	AMGNRLX	07/Oct.	5.1	0.07	4.4	8.3	.0155/.0242	.0002/.0006
Latvia	OMXRGI	07/Oct.	5	0.67	7.9	14.1	.0168/.0310	.0003/.0010
Serbia	BELEX15	07/Oct.	3.4	-0.28	10.9	20.5	.0186/.0336	.0004/.0011
Estonia	OMXTGI	08/Oct.	6.6	1.19	7	1.3	.0189/.0264	.0004/.0007
Indonesia	JKSE	08/Oct.	2.6	-0.51	11	10.3	.0224/.0326	.0005/.0011
Kazakhstan	KASE	08/Oct.	2.2	-0.58	12.9	6.6	.0231/.0582	.0005/.0034
Switzerland	SSMI	10/Oct.	9	1.89	8.1	-2.7	.0209/.0318	.0004/.0010
Australia	AXJO	10/Oct.	8.7	1.79	8.7	3.3	.0204/.0280	.0004/.0008
United Kingdom	FTSE	10/Oct.	7.7	1.61	9.3	1.3	.0240/.0338	.0006/.0011
Spain	IBEX	10/Oct.	6.5	1.01	9.6	-0.5	.0244/.0353	.0006/.0012
Czech Republic	PX	10/Oct.	5.2	1	16.2	6.2	.0267/.0465	.0007/.0022
Poland	WIG	10/Oct.	4.6	0.75	8.3	6.6	.0185/.0274	.0003/.0008
Croatia	CRBEX	10/Oct.	4.4	0.39	10.8	-4	.0211/.0399	.0004/.0016
Colombia	COLCAP	10/Oct.	3.8	-0.39	8.9	0.2	.0143/.0258	.0002/.0007
Peru	SPBLPGPT	10/Oct.	3.6	-0.29	11.4	-1.4	.0277/.0423	.0008/.0018
United States	DJI	15/Oct.	7.7	1.48	8.2	3.6	.0281/.0344	.0008 /.0012
Hungary	BUX	15/Oct.	5.1	0.91	12.6	21.6	.0285/.0410	.0008/.0017
Brazil	BVSP	15/Oct.	3.5	-0.01	12.1	13.2	.0398/.0445	.0016/.0020
Argentina	MERV	15/Oct.	2.9	-0.33	13	12.9	.0327/.0417	.0011/.0017
New Zealand	NZ50	16/Oct.	9.3	1.9	4.9	3.4	.0166/.0143	.0003/.0002
Japan	N225E	16/Oct.	7.3	1.31	12.1	9.4	.0310/.0406	.0010/.0017
Mexico	MXX	22/Oct.	3.6	-0.18	7.3	12.7	.0274/.0311	.0008/.0010
Singapore	FTSTIL	24/Oct.	9.2	1.71	8.7	4.6	.0264/.0253	.0007/.0006
South Korea	KS11	24/Oct.	5.5	0.78	8.7	5.9	.0096/.0107	.0007/.0001
Greece	ATG	24/Oct.	4.7	0.67	10.2	6.3	.0281/.0290	.0008/.0008
Guatemala	BSESN	24/Oct.	3.1	-0.62	11.6	13.8	.0294/.0329	.0009/.0011
Hong Kong	HSI	27/Oct.	8.1	1.63	13.6	0.2	.0349/.0384	.0012/.0015

Notes: * Negative sign indicates recovery with cumulative positive change. ** Volatilities measured as Standard Deviation of returns, 60 trading sessions before and 60 trading sessions after the largest drop.

Table 1. Research variables and descriptive statistics (continued)

Country	Index	Date (2008)	CPI	WGI	Drop (%)	Q_accum (%)*	Vol_SD -60/+60**	Vol_VAR -60/+60**
Austria	ATX	27/Oct.	8.1	1.81	10.3	6.8	.0402/.0383	.0016/.0015
Qatar	QSI	27/Oct.	6.5	0.55	9.4	10.8	.0355/.0319	.0013/.0010
Thailand	SETI	27/Oct.	3.5	-0.31	11.1	8.4	.0274/.0243	.0008/.0006
Lebanon	BLSI	27/Oct.	3	-0.77	6.8	2.3	.0158/.0131	.0003/.0002
Philippines	PSI	27/Oct.	2.3	-0.56	13.1	13.6	.0251/.0223	.0006/.0005
Nigeria	NGSEINDEX	28/Oct.	2.7	-1.12	3.6	6.9	.0113/.0179	.0001/.0003
Norway	OSEBX	06/Nov.	7.9	1.82	10.5	7.6	.0458/.0377	.0021/.0014
Bulgaria	SOFIX	18/Nov.	3.6	0.21	11.4	7	.0340/.0217	.0012/.0005
Slovenia	SBITOP	20/Nov.	6.7	1.12	8.4	7.1	.0308/.0174	.0010/.0003
Mauritius	MDEX	21/Nov.	5.5	0.88	6.4	12.4	.0189/.0140	.0004/.0002
Israel	TA35	24/Nov.	6	0.73	6.8	1.6	.0275/.0213	.0008/.0005
Canada	GSPTSE	01/Dec.	8.7	1.79	9.8	10.7	.0416/.0237	.0017/.0006

Notes: * Negative sign indicates recovery with cumulative positive change. ** Volatilities measured as Standard Deviation of returns, 60 trading sessions before and 60 trading sessions after the largest drop.

4.1 Statistical tests

According to Table 2, the Pearson Correlation Coefficient between the accumulated drop in auction with the biggest drop and the following with the CPI is significant at 1%, while the correlation with the WGI, at 5%.

Table 2. H₁: Correlation between cumulative drop, CPI and WGI

	CPI		WGI	
	r	t	r	t
Q_accum	0.32884	2.55877***	0.28216	2.16126**

Regarding the CPI, there is strong evidence in favor of H1. As for WGI, the evidence is not so clear, but the coefficient has the expected signal and is significant at 5%.

One of the dimensions that the IPC captures is the fight and control of corruption. Countries with low punishment mechanisms facilitate corruption, and in societies with more efficient punishment mechanisms, agents are more afraid and, if they act, they will be more careful (Paldam, 2002; Salmon & Serra, 2017). When there are no control and punishment, even if of moral nature, corruption becomes attractive and works like a business (Paldam, 2002) due to low risk and the possibility of gain.

The H₂ test involves comparing volatility in the period prior to the biggest drop with volatility in the subsequent period, using 60 (sixty) trading windows. The variables used to measure the volatility increase and the respective results are presented in Table 3.

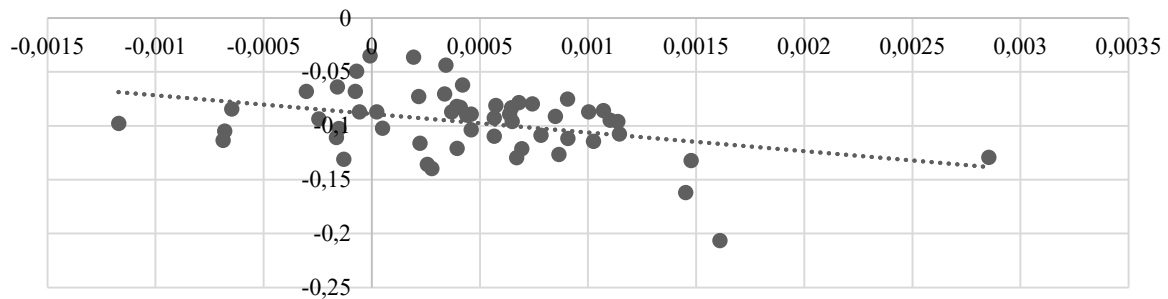
Table 3. H₂: Correlation and Student's t-test for increased volatility

	CPI		WGI	
	r	t	r	t
DIF_SD	-0.1559	-1.1705	-0.1158	-0.8644
RAT_SD	-0.1329	-0.9948	-0.0964	-0.7184
DIF_VAR	-0.2216	-1.6853**	-0.1786	-1.3465
RAT_VAR	-0.1585	-1.1904	-0.1146	-0.8556

Notes: DIF_SD – standard deviation difference, RAT_SD – standard deviation ratio, DIF_VAR – variance difference, RAT_VAR – variance ratio.

Although all calculated coefficients have the expected sign, only one of them is significant at 5%. Given these results, it is interesting to observe the relationship involving the difference between variances and the largest drop in researched stock markets.

The scatterplot Graph 1 shows a clearly decreasing pattern. The correlation coefficient between the increase in volatility, as measured by the difference between the variance in the 60 previous trading sessions and the 60 trading sessions immediately after the biggest drop with the biggest drop, equal to -0.38, is significant at 1%.



Graph 1. Relationship between increased volatility and drop of returns

In markets with lower perception of corruption and poor governance, the development rates are higher (Amavilah, 2009; Marino, Soares, Luca & Vasconcelos, 2016; Ortiz-Ospima & Roser, 2016; Vale, 2018), investors perceive greater stability and feel less subject to uncertainty. Countries with the highest perception of corruption generally have lower levels of development, less developed markets and greater instability.

As shown by Graph 1, countries with the biggest drop had greater increase in volatility. In these markets, investors react by drastically lowering their expectations and causing large variations, whereas in more developed markets, investors tend to keep their expectations, betting on recovery, and not reacting so sharply.

Ito and Hashimoto (2005) point out that a crisis can infect markets due to investors' behavior. Investors share information or bits of information that work with a ripple effect and make other investors revise their expectations. Thus, in the 2008 Financial Crisis, increased volatility is correlated with the size of the drop in financial markets and this drop is correlated with perceived corruption. However, there is no evidence that increased volatility is directly correlated with perceived corruption.

The relationship between increased volatility and perceived corruption is likely to be influenced by various factors such as market size, concentration level, foreign capital participation, and cultural and economic factors (Glaser & Saks, 2006; Dong & Torgler, 2013; Dong, Dulleck & Torgler, 2012; Dzhumashev, 2014; Salmon & Serra, 2017).

Thus, H_2 is not statistically evidenced, although this can be attributed to sample limitations.

Table 4 shows the results of the statistical tests for H_3 .

Table 4. H_3 : Correlation and Student's t-test for predictability

	CPI		WGI	
	r	t	r	t
ABS_DIF	-0.31981	-2.50326***	-0.27583	-2.12819**

Notes: ABS_DIF – Absolute difference between predicted return and calculated return for the day of the biggest drop

The results show that H_3 finds evidence in the sample. The estimated coefficients present the expected signals and the correlation with the CPI is significant at 1% and with the WGI, at 5%. Data show that the predictability of the drop was lower in countries with the highest level of perceived corruption.

Information from markets associated with lower confidence levels creates greater uncertainty, hindering predictability and undermining expectations (Ito & Hashimoto 2005; Paserman, 2017). The news are less reliable and can be unrealistic and may both increase and hide the severity of reported situations, increasing investors' uncertainty (Paserman, 2017). This increased uncertainty reduces effectively useful information and makes the behavior of investors and the market less predictable.

There was structural break in all countries of the sample. In fact, these results indicate that the 2008 Financial Crisis was an external event that shook all stock markets around the world. The correlation between the F values was estimated, once ordered with the CPI and WGI, obtaining the results of the 5.

Table 5. H_4 : Correlation between the order of F, CPI and WGI statistics

	IPC		WGI	
	r	t	r	t
F_Ord (Qe)	-0.4332	-3.5641***	-0.3859	-3.1023***

The values found were all significant at the 1%, meaning that the structural break was more evident in countries with higher perception of corruption. In other words, markets with more institutionalized corruption have experienced a more pronounced structural breakdown.

The literature points out that corruption has institutional causes and differ between markets (Dong & Torgler, 2013; Lee & Guven, 2013; Dzhumashev, 2014; Ortiz-Ospima & Roser, 2016). That said, the results found point to a relationship between external events, 2008 Financial Crisis, with internal characteristics, corruption. The absence of governance and corruption control mechanisms represent greater exposure to external economic events, making the internal market more vulnerable.

Regarding H_5 , the estimated correlation coefficients show the expected signals: CPI (0.2998) is significant at 5%, and the WGI (0.3413) at 1%. Thus, evidence is gathered that the stock markets of countries with the lowest perceived corruption rates were more spaced between the date of the structural break and the date of the biggest drop. Markets with less institutionalized corruption were more resilient to structural change, as expected. However, contrary to expectations, markets considered to be subject to a large margin of corruption soon showed structural resettlement.

Due to internal characteristics, markets show changes over a shorter or longer term. Agents in markets where corruption is more institutionalized are more distrustful and more vulnerable in crisis situations (Corsett, Pasenti & Roubini, 1999; Smick, 2009; Paulson Jr, 2010; Morales & Andreosso-O'callaghan, 2012), making them, when perceiving changes, quickly incorporate them into the new rules (Collier, 2002). However, in markets where corruption is less institutionalized, the reverse is true. Due to greater trust from agents, response to change tends to take longer.

Taken together, the H_4 and H_5 tests indicate that the drop in stock market returns due to contagion was followed by a deeper and more immediate structural break in countries where corruption was more institutionalized. This well represents the relative lack of confidence of the agents in the reorganization of markets.

5 CONCLUSIONS

The 2008 Financial Crisis, as well as the 1987 and 1929 Crisis, are unique, striking and revealing events. These are rare situations where markets become unbalanced and show characteristics that are not normally noticeable. Stock markets, in particular, are subject to a set of real and expected factors that make their analysis and forecasting complex, even in normal situations, and crises therefore represent a huge potential for information. Undoubtedly, the 2008 Financial Crisis, given its depth and breadth, is a valuable source of knowledge about stock market behavior.

In this article, the general hypothesis that the effect of the 2008 Financial Crisis was most pronounced on the stock markets of countries where the level of perceived corruption was highest, or where the level of governance was lowest, is confirmed.

According to the Institutional Choice Theory, the market, as an institution, needs to have a high level of confidence for its proper functioning. In normal situations, agents already feel less secure in markets with high institutionalization of corruption, as corruption erodes trust in institutions due to the pursuit of personal or group gratification, outside the law and moral principles. However, this is aggravated and strengthened by the contagion of a crisis of global dimensions, such as the 2008 Financial Crisis.

This study allows us to conclude that the 2008 Financial Crisis actually had different effects on stock markets around the world and that one of the factors explaining this phenomenon is the level of perceived corruption and governance of countries.

Certainly, several other factors intervene in the relationship analyzed here, as already pointed out, indicating the need for further research. In this sense, due to the statistical method used, the study presents only evidence of the relationship between corruption and the effects of the Financial Crisis of 2008, requiring more robust methods for further analysis. Nevertheless, the differentiated effect of the 2008 Financial Crisis could be evidenced according to the level of corruption institutionalization.

Just as an organism afflicted with an infection has its entire functioning changed, societies subject to a high level of corruption try to impose some control through legislation and regulation, which in practice means additional and growing difficulties for bona fide business. Thus, rather than being considered a lubricant for the business world from a short-term, romantic perspective, corruption is, over time, an endemic disease that inhibits business for lack of trust and imposes heavy restrictions to economic and social development, especially in crisis situations.

The 2008 Financial Crisis made it clear that the institutionalization of corruption severely weakens financial markets, making them more susceptible to dropping prices and exacerbation of volatility, with greater recovery difficulties.

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