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IMPACT OF DROP IN CRUDE OIL PRICES ON OMAN'S STOCK MARKET: AN ANALYSIS OF VOLATILITY

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ABSTRACT
The study involves returns of select companies listed on Muscat Securities Market, popularly known as MSM-30, Oman's capital market index, considering daily-returns of the firms. The study employed 'market model' for the computation of the abnormal returns and GARCH model for measuring volatility. The analytical results indicate that a significant number of companies have recorded negative cumulative abnormal returns during the 'event window' period implying that there is a significant impact of a drop in oil prices on the returns of firms.

INTRODUCTION
Global oil prices have witnessed unprecedented volatility on account of various causes. Oil price analysts and economists have diverse opinions on the topic. However, one of the primary causes contributing to these fluctuations could be attributed to the highly complex demand & supply and global economic conditions. There are three different types of producers of crude oil such as government-owned oil companies like Saudi Aramco which is considered to be an arm of the government of Saudi Arabia, wherein the policies regarding price-fixing is decided by the government irrespective of the scenario prevailing in the global market. So, fluctuations in crude oil prices are unavoidable as it is government policy, rather than the market forces, which are taken into consideration in fixing oil prices. The second important cause which contributes to high volatility in oil prices is that a few selected multinational companies (MNCs), which are answerable to the shareholders constitute a majority of exporters of oil production. Shell and British Petroleum (BP) are the best examples, here. These MNCs not only focus on market forces but consider the return on investment (RoI) as well, thus eventually contributing to fluctuations in oil prices.

Yet another category of crude oil producers is national oil companies such Petrobras of Brazil. These companies operate in a constrained environment where they should factor in both national goals as envisaged in the government policies and should achieve the corporate goals and objectives, as well. A few other aspects contributing to the high degree of volatility could be attributed to the slowing growth in China and Brazil. In addition, there have been no tangible improvements or certainty of promising economic outlook in the Eurozone during the past five years. Environmental policies of governments across the globe advocate in favor of moving away from crude oil and insist on exploring alternative energy sources. Poor economic outlook and OPEC's production cuts have also added to speculations resulting in a higher degree of volatility in oil prices. The most important issue is that consumers cannot change their consumption patterns nor switch over to alternative products to satisfy their demands. The need for the present study gains significance on account of the above developments in the oil price behavior as these prices coupled with volatility have a direct impact on gulf economies that largely depend on oil exports as the most important source for government revenue and fiscal needs. With higher volatility being witnessed in the crude oil prices over the past almost five years, the oil-driven economies have faced tremendous pressure in many sectors including manufacturing, services, banking, financial and other sectors. Again, such unprecedented volatility has taken a toll on the employment scenario, as well.

IMPACT OF OIL PRICE VOLATILITY ON GULF ECONOMIES
Oil price volatility plays an important role in gulf countries which includes six Gulf Cooperation Council member countries (GCC) namely, Bahrain, Kuwait, Qatar, Oman, Saudi Arabia, and UAE as the government revenue and spending largely depend on crude oil exports. Every GCC country aims at diversification of its economic activities to do away with excessive dependence on oil exports. This is all the more necessary to maintain the exchange rate stability of the Gulf economies. Recent crude oil price movements are shown in the Fig. 1 below:

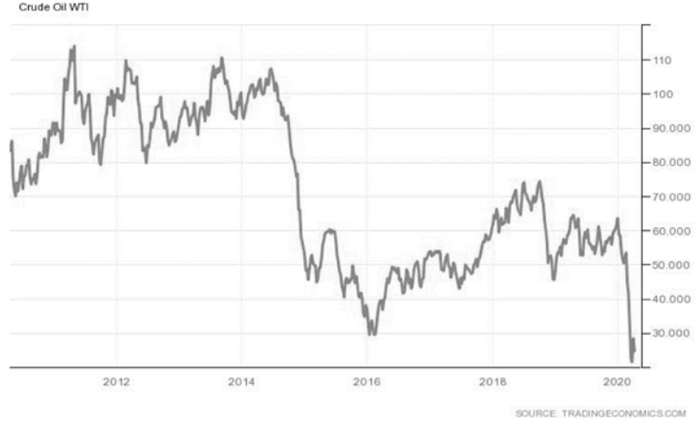

Fig. 1. Crude oil price
Source: https://tradingeconomics.com/commodity/crude-oil | Accessed on April 9, 2020.

According to an estimate, the Sultanate of Oman has oil reserves of around 5.4 billion barrels and the country is ranked as the 7th major oil reservoir holder in the Middle East and 22nd at the global level (EIA, 2017). In the era of high oil-price, the economy of Oman witnessed an upside transformation wherein GDP tripled and the country observed current and fiscal account surpluses.

However, in contrast with other gulf countries, Oman has limited accessibility of oil reservoirs. In case low oil price persists, the country could face fiscal difficulties (S. Al-Maamary et al., 2017). The variation in oil-prices will have an adverse effect on the economy of the country (Hakro & Pandow, 2019). However, the extent of the shock will depend on the ability to comeback from external shocks. Such developments will have an impact on the capital market of the country.

MUSCAT SECURITIES MARKET

The Sultanate of Oman established a stock exchange known as Muscat Securities Market (MSM) on the 21st of June 1988 under the Royal Decree number 53/88 for the purpose of controlling and regulating the securities market of Oman. Since then the market is developed and well participated in by the locals and foreigners as well. The Muscat Securities Market index [MSM-30] is a capitalization-weighted index of the thirty highly value and liquid firms listed on Oman securities market. In June 2004, the index was developed at a base level of 1000. To ensure vibrancy in the index, 30 listed companies are included in the MSM-30 index across all the major economic sectors viz. Services, Industry, Banks, Insurance and Investment. As stated in the earlier section that Oman economy is driven and based mainly on oil exports, and any variation in the oil prices has an impact on public finance which in turn has an impact on the stock market as well (Pandow, 2018).

At present, there are 163 securities listed on the Muscat Securities Exchange with a market capitalization of OMR9835019315 and value traded at OMR18,343,622, having investors from 115 nations with foreign investment at 25%.

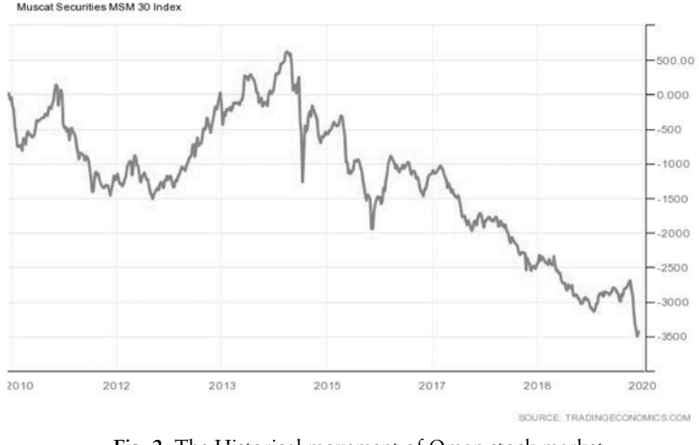

Fig. 2. The Historical movement of Oman stock market
Source: Trading Economics | Accessed on April 9, 2020.

Fig.2 above shows the historical movement of the MSM-30 index from 2010 till mid-2020. As is shown, there was a sharp decline in the index in 2009 followed by another recent dip since mid-2014.

NEED FOR STUDY

Of late, volatility in crude oil prices has left an impact on various sectors, more particularly, banking, insurance and manufacturing sectors. Since all these sectors/companies have been directly connected to the financial markets and are listed on the stock exchanges, a study on the volatility becomes necessary. We undertake this research work primarily on two grounds.

Firstly, empirical research studies undertaken in the past indicate that whenever oil prices have faced a higher degree of volatility, they have generally resulted in a significant reduction in hiring of qualified individuals for various positions and job categories.

Secondly, GCC economies, for almost six decades, have been heavily depending on crude oil exports to finance their government's budgetary requirements and developmental needs. Although crude oil prices have witnessed see-saw movements in the past, a drastic drop in 2018 raised the alarm for almost all the oil-exporting countries. It was a kind of sudden shock that they faced owing to an unprecedented crisis-like scenario in May/June 2014 when the oil prices took a downward spiral. It is common sense that when a government faces budgetary constraints, it would take a hit on the expenditures and spending.

LITERATURE REVIEW

A succinct review of the literature indicates that a large number of papers have focused on the impact of oil price volatility on share price behavior. Many models have been developed in order to measure the impact of oil prices on the share price returns of companies and stock price indices. In this section, we present the previous research works carried out in the area of oil price behavior and its impact on the share price returns of companies. Towards the end, a summary and criticisms of the literature is also presented.

Broadstock, David, & Filis, (2014) examined the relationship between oil price shocks and stock market returns with the stock market indices of two countries, China and the US. Using the aggregate stock market data for the period from 1995 to 2013, they applied the Scalar-BEKK model to analyze the data. Metals & mining, oil & gas, retail technology and banking industry were included in the sampling framework. Their findings revealed some interesting patterns. They noticed that correlations between oil price shocks and stock returns were systematically time-varying. Secondly, they noticed that oil shocks of different types had shown varying impacts on stock market returns. Quite interestingly, the authors noticed that the impact was widely mixed across different sectors. Further, Chinese markets have exhibited more resilience to oil-price volatility

when compared to the US share price indices. The most interesting aspect is that the two samples chosen represented two giant economies, the US, being highly developed and China, a fast-emerging global economic giant.

On the other hand, a study undertaken by Hayo & Kutan, (2014) used daily returns in Russia over a period from September 1995 to November 2001 to examine the impact of oil news on Russian stock and bond markets. They noticed that the US stock market index returns Granger-cause the returns recorded by Russian markets. They further found that Russian market returns depended on developments in global financial markets. The authors have noticed that a higher degree of financial liberalization would have a deeper impact on US market returns and Russian financial markets. Yet another important finding revealed by this research was that the Russian stock market was sensitive to oil price changes and could significantly destabilize Russian markets.

Kilian & Park, (2009) examined whether an increase in the price of crude oil had any impact on the crude oil market. They developed a new methodology to understand the fluctuations happening in stock markets and their relationship with oil price shocks. Using sample data for the period 1975-2006, they examined the relation between the returns in share price and oil price shocks. The results indicated that oil demand and oil supply shocks explained a fifth of the long-run variations registered in the US real stock returns. They further found that the responses of US-real stock returns to oil price shocks differ substantially depending on the underlying causes of the oil price increase.
Managi & Okimoto, (2013) examined the relationship between oil prices, clean energy, stock prices and technology prices applying Markov-Switching Vector Autoregressive models with an economic system comprising oil prices, clean energy stock prices, technology stock prices and interest rates. They found a positive relationship between oil prices and clean energy prices after structural breaks. They further found that there existed a similarity in response to the market reaction in both energy stock prices and technology stock prices.

Filis, Degiannakis, & Floros, (2011) examined the time-varying correlation between stock prices and crude oil prices for both importing and exporting countries. They applied DCC—GARCH-GJR approach to test their hypothesis with the data gathered from six countries. USA, Germany and Netherlands were included in the samples for oil-importing countries while Canada, Mexico and Brazil were included in oil-exporting countries. The period included was from 1987 to 2009. The authors found out that the time-varying correlation of oil and stock prices do not differ for both sets of sample companies. Yet another interesting finding of the present study by the authors is that the results of correlation analysis changed in response to the origin of the oil price shocks during periods of world turmoil and during the different phases of business cycles witnessed by the global markets.

Wong & El Massah, (2018) analyzed the impact of oil price changes on GCC markets over a period of ten years from 2005 to 2015. Bahrain, Kuwait, Oman, Qatar, Kingdom of Saudi Arabia and United Arab Emirates were included in the sampling framework. Applying Granger-causality impulse response function, the authors examined the direction of influence and influence absorption. The results provided a few pointers to portfolio management at the international level and also offered useful insights to the governments and regulatory authorities to manage the situation during oil price changes. Also, the authors suggest that further economic diversification, particularly, in the GCC region, is required at the country level in order to mitigate the volatile situation in oil price behavior.

In a recent report by IMF, Cheikh et al., (2018) examined the impact of oil price volatility on the Gulf Cooperation Council's stock markets. Applying non-linear smooth transition regression (STR) models they found out that GCC markets did not register similar sensitivity to oil price changes. Asymmetric information has been registered in a few GCC countries with regard to oil price changes. Mixed reactions have been noticed for the different markets in the GCC markets. The authors further highlight the importance of measures that would reduce the sensitivity of oil price changes to various economic situations. They suggest that economic stabilization and reform measures are necessary to mitigate the effect of oil price changes.

Brandt and Gao, (2019) examined if macroeconomic fundamentals and geopolitical events affect crude oil markets. They used sentiment scores for a set of global news pertaining to these two events. They found that news related to the macroeconomic fundamentals have an impact on the oil prices in the short run and is also helpful in significantly predicting oil price returns in the long run. Yet another interesting finding according to the authors is that geopolitical news has a much stronger immediate impact on the oil price behavior but exhibits no predictability.

It has been observed that oil price volatility and its impact on share price returns have mixed results. It is interesting to note that Chinese markets exhibit more resilience when compared to American stock markets. Similar way, research works on Russian markets have revealed that share price returns have the ability to destabilize the stock markets. So, investors in these markets have to exercise extra precautions during volatile periods. GCC markets, on the other hand, have posted a mixed reaction to the oil price changes.

OBJECTIVE OF THE STUDY

The present study, which attempts to examine the impact of oil price volatility on stock returns in Oman's MSM Index, has the following objectives:

a.) To analyze if the oil price-behavior affect the stock return of firms
b.) To examine the volatility of a firm's return pre and post drop in oil prices
c.) To measure the sector-specific impact on the stock return due to the drop in oil prices

HYPOTHESIS

H_1: There is no impact of a drop in oil prices on the stock return of firms
Some studies that have examined the impact of oil prices on the firm returns Reboredo & MA, (2014). The results show a long-run relation between oil price and stock returns. While Bastianin, Galeotti, & Manera, (2017) established that there is a dynamic response of oil-price with regard to the financial markets. So, in order to confirm these findings in the context of Oman, the hypothesis is tested in this study.

H_2: The volatility of a firm's returns pre and post drop in oil prices is not significant statistically
Researchers have gone further and attempted to assess the cross-sectional pricing of oil volatility exposures (Christoffersen & Pan, 2018). A study by Smyth & Narayan, (2018) has further demonstrated how in practice oil prices interact with stock returns.

H_3: The impact on firm returns due to oil prices volatility is not sector specific.
The research by Narayan & Sharma, (2011) have provided evidence on how the oil-price affects the returns of firms variedly depending on the sector. Also, Waheed, Wei, Sarwar, & Lv, (2018) studied industry specific responses of oil prices and found that the volatility in oil prices and its impact on 137-firms and validated that there is negative-relationship oil prices and stock return of firms.

METHODOLOGY

The primary purpose of the study is to examine whether there is an impact of oil price volatility on the return of firms. Also, the volatility of a firm's returns pre and post drop in oil prices is analyzed. The study uses the market model to calculate the abnormal returns (ARs), average abnormal return (AAR), cumulative abnormal return (CAR), and cumulative average abnormal return (CAAR). Various studies like Fama *et al.*, (1969) and Musumeci, (1985) have used the market model in their studies hence the reason to use it (Pandow & Butt, 2021). The AR of the sample firms has been computed using the following formula:

$$AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_{m,t})$$

And for the AAR we used the following calculations:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t}$$

CAR is calculated using formula:

$$CAR_i = \sum_{t=T_1+1}^{T_2} AR_{i,t}$$

And then CAAR is calculated as:

$$CAAR = \frac{1}{N}\sum_{i=1}^{N} CAR_i$$

The standardized cumulative abnormal return (SCAR) is defined as

$$SCAR_i(\tau_1, \tau_2) = \frac{CAR_i(\tau_1, \tau_2)}{S_{CAR_i(\tau_1,\tau_2)}}$$

Where $SCAR_i(\tau_1, \tau_2)$ is the standard-deviation of the CAR adjusted for the forecast error, the Patell, (1976) test statistic is

$$t_{patell} = \sqrt{\frac{n(L_1 - 4)}{L_1 - 2}}\,\overline{SCAR_r}$$

Whereas $L_1 = T_1 - T_0$ is the length of the estimation-period, SCAR (τ_1, τ_2) is the average of the standardized CAR.

The present study uses an event window of 60 days and an estimation window of 500 days. Though the researchers have used varied event and estimation windows for their studies most of the scholars have used 60 and 500 days event and estimation window respectively (Oler et al., 2007). For estimation of abnormal-returns and time-varying volatility, the study used the market model with GARCH errors (Bollerslev, 1986) and (Pandow & Butt, 2019). We employed purposive multi-stage sampling technique for this study and a selection criteria was necessary in order to include a company in the sample. This study considers nineteen listed firms in the MSM-30 index as rest of the companies don't fulfill the criteria of having price data for eight years from mid-2010 to mid-2018. Also, other companies were not included in the sampling as they were not included in the MSM-30 index during the study period.

RESULTS AND DISCUSSION

As mentioned above, the researchers considered nineteen firms that are listed in the MSM-30 index for this study. The estimation period is from mid-2010 to mid-2018. The price movements of the select firms are plotted and are shown in the Fig. 3.

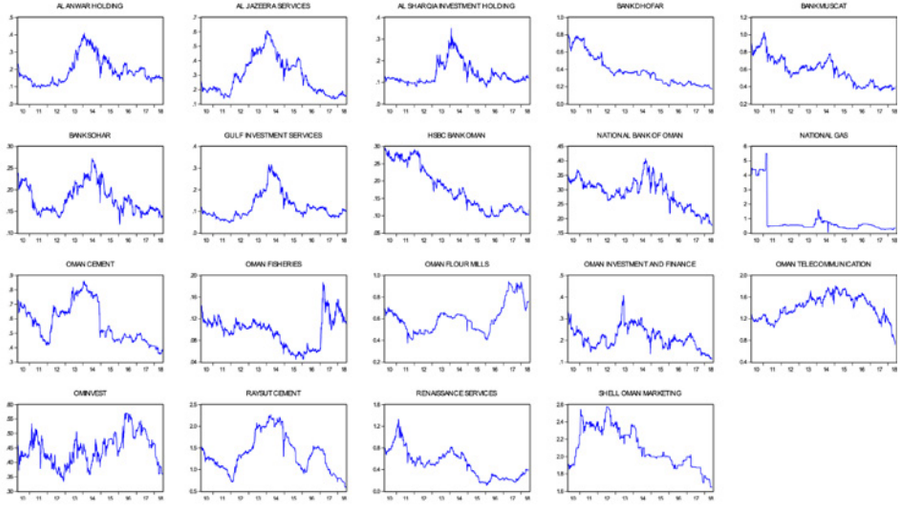

Fig. 3. Share price movement of the select firms listed in MSM-30

MEASUREMENT VALIDITY

The significant measure before modeling the time-series data is to test the raw data for the presence of unit root or stationarity. The data series is considered to be stationary if it has constant-mean, auto-covariance and variance for each lag. Otherwise, the data-series is non-stationary and is considered to have a unit-root. In order to check stationarity properties of time-series data, we applied Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test (Gujarati, 2004) as the stationarity of the time-series-data is a precondition for applying regression analysis.

The p-value for the ADF and PP test is at 0.9689 and 0.9579 respectively at level, which suggests presence of the unit-root and non- stationary of the data series. To take it further, we had to first convert the non-stationary data into their first differences before running the market model. This suggests the absence of the unit-root and the stationary of the time series data. Also, we plotted individual first difference price movement of the select firms in Fig. 4.

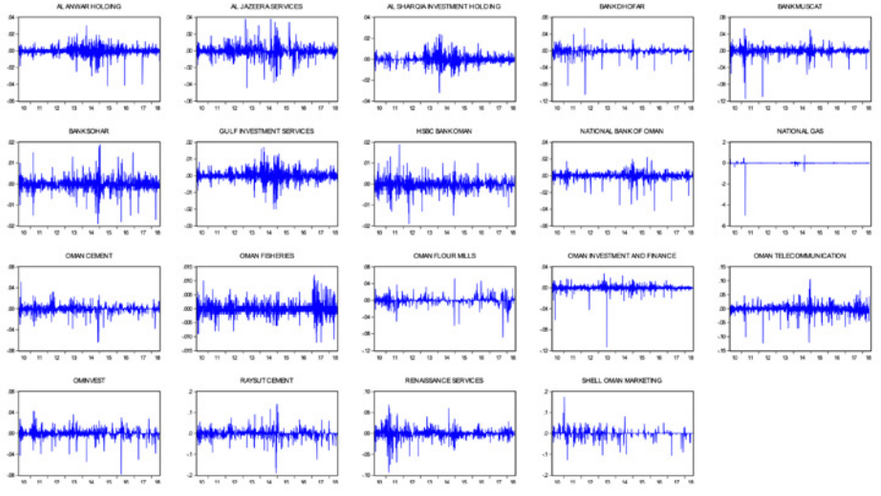

Fig. 4. Individual differenced price movement of the select firms listed in MSM-30

The indices movement of the MSM-30 for the period is plotted as shown in Fig. 5.

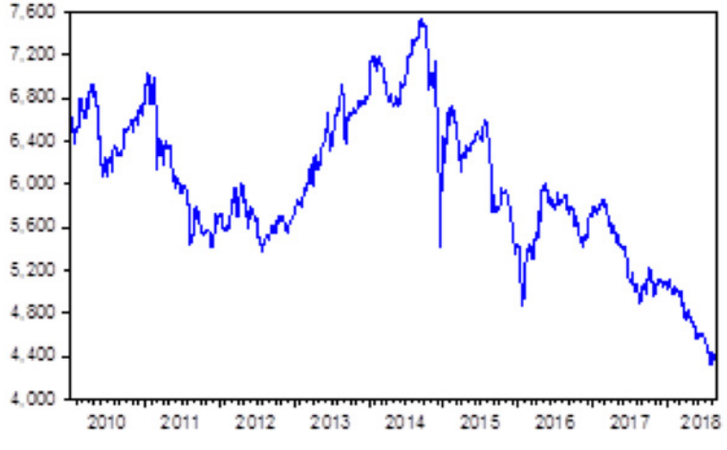

Fig. 5. Movement of MSM-30 index at level (Source: Authors plot)

Similar to individual stock prices, the unit root test was performed for the MSM-30 index. The p-value for the ADF test is at 0.7527, which suggests the presence of the unit-root and the non-stationary of the time series data. Again, we converted the non-stationary time series data into first differences before using it in the market model. The p-value for ADF test is significant which suggests the absence of unit-root and stationary of the time series data.

Also, the plotted individual first difference price movement of the select firms can be seen in Fig. 6.

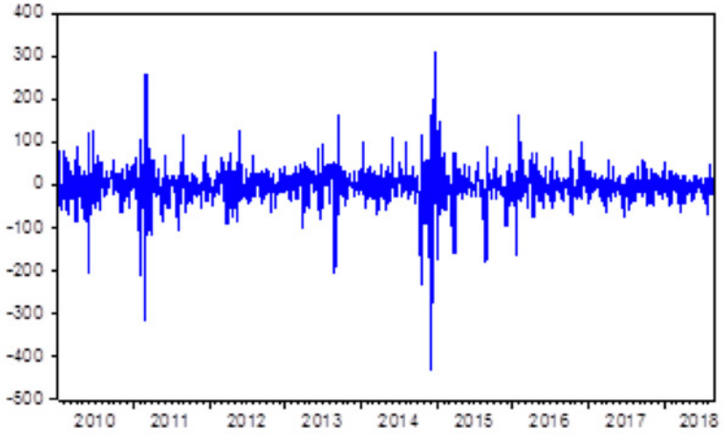

Fig. 6. Movement of MSM-30 index at first difference

RESULTS

We calculated the average abnormal returns on the following sectors: Financial, Industrial and Services. Overall, we observed that there was a reaction in the firm returns as can be seen from the Fig.7. However, the reaction is varied and depends on the sector analyzed. Also, we found that on the next day of the trigger event i.e., drop in crude prices, the services sector had a sharp dip followed by the industrial and financial sector. The results are in conformity with Waheed *et al.*, (2018) study.

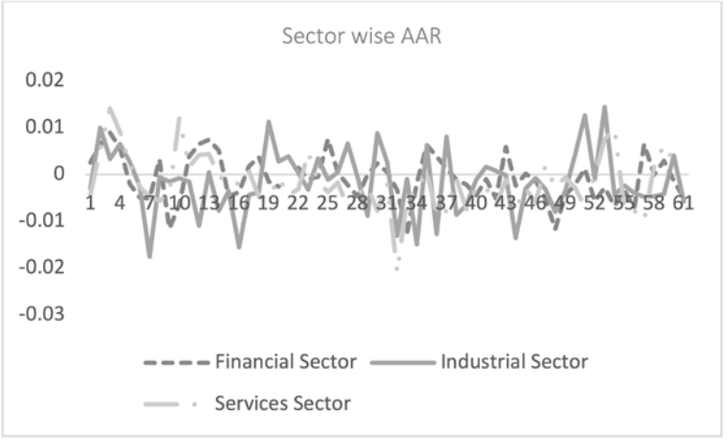

Fig. 7. Sector-wise plot of AAR for 60-days (Source: Authors plot)

The sector-wise analysis reveals the presence of CAAR in the industrial and service sector. However, it is absent in the financial sector during the 'event window'. We then employed Patell-Z and Rank-Z tests to check the statistical significance and its corresponding p-values.

Table 1. Sector wise analysis of CAAR for select cos listed in MSM-30 index

GROUPING VARIABLE	CAAR TYPE	CAAR VALUE	POS:NEG CAR	PATELL Z	P-VALUES
FINANCIAL SECTOR	(-30, 30)	-0.049	6:3	0.287	0.776
INDUSTRIAL SECTOR	(-30, 30)	-0.095	1:3	-2.607	0.014
SERVICES SECTOR	(-30, 30)	-0.110	2:4	-2.537	0.011

Table 1 presented above shows statistically significant p-values for industrial and service sectors. However, the financial sector doesn't have a statistically significant p-value. So, we can reject hypothesis-3 which states that the impact on firm returns due to oil prices change is not sector-specific. The reason, probably, could be due to the fact Oman is not a well-diversified non-oil economy, hence a direct impact and strong relationship between oil-price variations and performance of the financial sector, while other sectors like industrial and service sector remains unaffected empirically as explained by (El-chaarani, 2019). These findings are similar to that of Mensi, (2019), and Yasmeen, Wang, Zameer, & Solangi, (2019) who have found varying responses of sectors viz. oil price fluctuations. There are other studies that have suggested the government of Oman to use oil revenues to develop other non-oil industrial sectors (Alshubiri et al., 2020).

Also, we reject hypothesis-1 as there is an impact of a drop in oil prices on the returns of firms as could be observed in Table 2. These results are in conformity with the findings of Sadorsky (1999), Echchabi & Azouzi, (2017) and (Pandow & Butt, 2018) which found no significant impact of the oil-price shocks on stock returns.

Table 2. Firm wise analysis of CAR

EVENT ID	WINDOW	CAR VALUE	CAR T-TEST	P-VALUE
HSBC BANK OMAN	(-30, 30)	0.101	1.302	0.193
BANK MUSCAT	(-30, 30)	0.097	1.15	0.250
BANK SOHAR	(-30, 30)	0.025	0.353	0.723
GULF INVESTMENT SERVICES	(-30, 30)	-0.356	-2.575	0.010
BANK DHOFAR	(-30, 30)	0.114	0.994	0.320
NATIONAL BANK OF OMAN	(-30, 30)	0.227	3.137	0.001***
AL ANWAR HOLDING	(-30, 30)	-0.346	-2.347	0.019**
OMINVEST	(-30, 30)	0.079	0.747	0.455
AL SHARQIA INVESTMENT HOLDING	(-30, 30)	-0.385	-1.898	0.058*
RAYSUT CEMENT	(-30, 30)	-0.207	-2.829	0.004**
OMAN FISHERIES	(-30, 30)	-0.034	-0.336	0.736
OMAN FLOUR MILLS	(-30, 30)	0.022	0.218	0.827
OMAN CEMENT	(-30, 30)	-0.163	-2.245	0.025**
AL JAZEERA SERVICES	(-30, 30)	-0.503	-3.816	0.000***
NATIONAL GAS	(-30, 30)	0.220	0.252	0.801
OMAN INVESTMENT AND FINANCE	(-30, 30)	-0.217	-1.221	0.222
OMAN TELECOMMUNICATION	(-30, 30)	0.097	1.649	0.099*
RENAISSANCE SERVICES	(-30, 30)	-0.218	-2.275	0.023*
SHELL OMAN MARKETING	(-30, 30)	-0.038	-0.799	0.424

Besides, we have analysed the cumulative abnormal return for a window of 60 days and found that ten firms i.e. 52.63 percent have negative CAR while nine companies have shown the positive CAR. While six companies which registered negative CAR are statistically significant.

Table 3. Firm wise analysis of volatility

FIRM	ALPHA	P-VALUE	BETA	P-VALUE	PRE LAMBDA	POST LAMBDA
HSBC BANK OMAN	-0.001	0.000	0.945	0.000	2.239	4.036
BANK MUSCAT	-0.000	0.646	1.128	0.000	2.369	2.176
BANK SOHAR	0.000	0.785	1.238	0.000	2.210	2.501
GULF INVESTMENT SERVICES	0.000	0.627	2.014	0.000	3.959	3.308
BANK DHOFAR	-0.002	0.016	1.180	0.000	2.878	1.329
NATIONAL BANK OF OMAN	-0.000	0.640	0.912	0.000	1.991	3.080
AL ANWAR HOLDING	0.000	0.28	2.373	0.000	4.364	7.600
OMINVEST	-0.001	0.126	1.547	0.000	2.883	2.381
AL SHARQIA INVESTMENT HOLDING	-0.000	0.454	1.317	0.000	5.252	4.913
RAYSUT CEMENT	0.000	0.189	1.047	0.000	2.122	3.273
	-0.000	0.154	1.037	0.000	2.846	5.448
OMAN FLOUR MILLS	-0.000	0.585	0.272	0.045	2.240	0.375
OMAN CEMENT	-0.000	0.395	0.600	0.000	1.937	1.881
AL JAZEERA SERVICES	0.000	0.296	1.325	0.000	3.386	5.667
NATIONAL GAS	-0.001	0.301	0.044	0.752	14.588	2.291
OMAN INVESTMENT AND FINANCE	-0.009	0.972	2.938	0.951	4.637	5.789
OMAN TELECOMMUNICATION	-0.000	0.341	0.611	0.000	1.579	1.656
RENAISSANCE SERVICES	-0.000	0.579	1.307	0.000	2.784	1.322
SHELL OMAN MARKETING	-0.000	0.503	0.159	0.067	0.996	0.762

The analysis of volatility for individual companies can be seen from Table 3. It is observed that in case of most of companies, pre and post volatility does not change as Pre and Post lambda, is similar to the finding of Christoffersen and Pan (2018).

Also, for checking the statistical significance of the pre and post lambda we performed t-tests assuming unequal variance and found that the p-vlaue is at 0.361 which is not statistically significant even at 10 percent level as shown in Table 4. So, we accept the hypothesis-2 which states that the volatility of firm returns pre and post drop in oil prices don't change and remains the same. Similar findings are recorded by Smyth & Narayan, (2018) and (Al-mawali et al., 2016). However, the finding are in contrast to those of Arouri, Jouini, & Nguyen, (2012), wherein the study has noticed that oil-price returns appears to be more volatile than stock-returns.

Table 4. t-Test for Pre-lambda and Post-Lambda

	Pre-Lambda	Post-Lambda
Mean	3.435352632	3.147205263
Variance	8.478084237	3.828970404
Observations	19	19
Hypothesized Mean Difference	0	
Df	32	
t Stat	0.358025858	
P(T<=t) one-tail	0.361337465	
t Critical one-tail	1.693888748	
P(T<=t) two-tail	0.722674929	
t Critical two-tail	2.036933343	

CONCLUSION

We conclude the paper with the finding that suggests 52.63 percent of the select companies have negative CAR while nine companies have shown positive CAR. So, we reject the Null hypothesis which states there is no impact of drop in oil prices on the returns of firms. In the case of industy and services sector, we found abnormal returns. However, the financial sector has not had any impact which suggests that the impact on firm returns due to oil prices change is sector-specific.

Besides, we analysed pre and post lambda using the GARCH model and found that the difference is not statistically significant. So, we accept the hypothesis which states that the volatility of firm returns pre and post drop in oil prices don't change and remain the same.

This study has a limited scope as it is based on the select nineteen companies out of thirty listed in MSM-30 index which is equivalent to 63.33 percent of all the companies included in the index. The time period is for eight years involving pre 4 and post 4 years of daily data for each of the selected companies. Also, the study is limited to the Sultanate of Oman only. Besides, many other factors could be responsible for the price movement of the companies and the market. However, we have not taken all those factors into consideration.

Future research can be conducted by studying all the thirty firms listed in MSM-30 indices so as to make it an all-inclusive study. Also, the period of the study could be extended to have a more in-depth understanding of the price movements of the companies.

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ASSET ALLOCATION IN CHINA ONSHORE BOND MARKET

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ABSTRACT
The Bond Connect scheme, launched in July 2017, has opened up China's domestic bond market to foreign investors. This paper uses the newly introduced China bond indexes and other bond indexes to examine the advantages of allocating funds to China bonds for fixed-income portfolios. The results show that China bonds offer higher yields, lower volatilities, and negative or low correlations with other markets. Furthermore, the estimated rolling correlation coefficients suggest that the correlation relationships change over time. The results have implications for international investing in index-tracking funds and exchange-traded funds.

INTRODUCTION
The Chinese onshore bond market is the third largest in the world, ranked behind the United States (US) and Japan. In the past, foreign participation was limited. However, in March 2016, the Beijing government granted long-term foreign institutional investors access without trading quotas or repatriation restrictions. Furthermore, China launched Bond Connect in July 2017 that opened the floodgate for foreign investors to access the market via Hong Kong.

To offer investors benchmarks to measure the performance of the Renminbi (RMB) bond investments, FTSE launched FTSE China Onshore Bond Index series. This paper is an early academic research that utilized the new FTSE bond indexes. In addition, we also included Eurozone and several European country government bond indexes. The observations are that China bonds offer higher yields than other countries. The empirical results also showed negative or low correlations, for the entire sample period and for the rolling annual correlations. As such, China onshore bonds offer higher yield potential and help lower portfolio volatility. The results are consistent with observations in non-academic reports (for example, FTSE Russell, 2016(a) and 2017(b); Hu, et al., 2017; Reilly, 2017; Kornchankul, 2017). Moreover, our results showed that the China bond index returns have lower volatilities than other indexes in the sample. Previous publications have not identified such characteristics.

CHINA OPPORTUNITIES
China is now the second largest economy and has experienced sustained high growth rate for several decades. Economic reforms, inflow of foreign direct investment, and membership in the World Trade Organization (WTO) are among the major contributors to China's growth. In the past ten years (2007 – 2016), China's economy grew at about 6 – 7 percent. China's gross domestic product (GDP) increased from $3.55 trillion in 2007 to $11.20 trillion in 2016. Annual trade surpluses have accumulated large sums of foreign exchange reserves, which have major impacts on international commodities prices and interest rates.

Such huge and fast growing economy presents attractive investment opportunities for global investors. Appreciation of the Chinese Renminbi (RMB) also added returns to securities investments during the first several years after July 2005 when China allowed its currency to float (though within a small band). Allocating a certain portion of funds in Chinese securities is prudent as it provides for a better diversification and a higher return potential. Foreign investors, however, have limited venues to enter the Chinese financial markets. Over the years, the Beijing government has taken steps to gradually open its markets to foreign investors. The following subsections discuss the stock market and then the bond market. A brief literature review relating to each market is also provided. Thereafter, we briefly cover the RMB market.

STOCK MARKETS
With the inclusion of 99 Chinese A-shares into the MSCI indices, the Chinese stock market will experience a greater internationalization. Foreign investors can invest in China via several means. Many Chinese companies have listed their shares overseas on exchanges such as Hong Kong Stock Exchange, New York Stock Exchange, and London Stock Exchange. In addition, some mutual funds invest in those stocks or acquire shares in China directly via the Qualified Foreign Institutional Investor (QFII) or Renmibi Qualified Foreign Institutional Investor (RQFII) scheme.

Researchers have examined various aspects of Chinese stock market returns. For example, Carpenter and Whitelaw (2017) discussed the growth of China's stock market and the growing literature on China's financial markets. They documented the development of research in biases in selecting firms for listing, massive underpricing of initial public offerings, the premium of A-shares over their foreign-share counterparts, and systematic cross-sectional patterns in returns. Research interests continue to expand as China's stock market continues to grow in global influence. Carpenter, et al. (2017) showed that stock prices in China are correlated with corporate fundamentals. Investors pay up for large cap stocks, growth stocks, and actively traded stocks. They also discussed that China represents over 10 percent of the global stock market, and yet foreign ownership of Chinese stocks is very low. In addition, they documented that China's stock

markets offer high average monthly returns and low correlations with other stock markets. The risk adjusted excess returns are estimated to be over 1 percent per month in their sample period.

Many publications have also examined the price differentials for companies cross-listing their shares in China (A-shares) and in Hong Kong (H-shares). Fang (2017) showed that there is information and causality relationship between those cross-listing stocks. The direction of information flow is related to the different closing time between Shanghai Stock Exchange and Hong Kong Stock Exchange. Fang (2017) also documented the factors contributing to the price spreads of cross-listing stocks. Those factors include different investor expectations and risk premium, different regulations, different currencies between the two segregated markets. In addition, A-shares and H-shares are not exchangeable. FTSE Russell (2016(b) and 2017(a)) discussed the arbitrage of the anomaly between A-shares and H-shares.

On the relationship between the stock market and the economy, Allen, et al. (2015) examined reasons for the disconnection between economic growth and stock market performance. Since its inception in 1990, the Chinese stock market has been growing fast. Combining all firms listed in Chinese exchanges and Hong Kong Stock Exchange, the Chinese stock market is the second largest in the world, next to the US market. However, the performance of the Chinese stock market has not been in line with its economic growth. They documented that in many other countries stock market returns are strong predictors of GDP growth in the following year. They showed that Chinese firms have much higher levels of investment compared to listed firms from the US, Japan, India, and Brazil. Chinese firms generate lower net cash flows, leading to low investment efficiency. Lower cash flows are also associated with more related-party transactions, indicating deficiencies in corporate governance.

BOND MARKET

In fixed-income area, foreign access to the local market has been more restricted. The yields in China are higher than in many other markets. The onshore 10-year government bond, for example, traded at 100 basis points or more over Korea, Singapore, Japan, US, UK, and Germany (HU, et al., 2016; FTSE Russell, 2017(b)). Yet only about 2 to 3 percent of Chinese bonds are foreign-owned. Progress, however, has been made. In Hong Kong (HK), there is a Dim Sum bond market. Dim sum bonds are issued in HK and denominated in RMB. Global investors can invest in those bonds, gaining exposures in Chinese bond yield and currency. In addition, foreign investors have access to Chinese bonds via the QFII, RQFII, and the new Bond Connect schemes. Furthermore, there is increasing issuance of Panda bonds by sovereign issuers. Panda bonds are denominated in RMB by foreign issuers and sold in Mainland China.

Research on the Chinese bond market covered the development, the steps taken by the Beijing government to open up the market, the higher yields, and issues related to credit ratings. Bai, et al. (2013) described the history and structure of the Chinese bond market. They showed that trading in individual bonds was historically sparse but has increased in recent years. Furthermore, announcements of macroeconomic news, such as China's producer price index (PPI) and manufacturing purchasing managers' index (PMI), have significant effects on bond yields. Despite the increased activity in the market, their analyses rejected the null hypothesis of market efficiency under two different tests for four of the most actively traded bonds.

Livingston, et al. (2017) studied the Chinese bond market and credit rating industry. They showed that Chinese bond ratings are informative and are significantly correlated with bond yields. In addition, Chinese bond investors distinguish ratings from different credit rating agencies, accepting lower yields on bonds rated by rating agencies with better reputations and more stringent standards. The empirical results also showed that the rating scales in China are not comparable to those in international markets. Furthermore, Chinese rating agencies have very broad rating scales and pool bonds with significantly different default risks into a single rating category, resulting in over 90 percent of bonds in only three rating categories.

Huang and Zhu (2017) reviewed historical development and discussed future of Chinese bond market. Historical lessons on sovereign right concession and market tumult lead to a cautious approach towards the bond market. The legal background and political considerations also played an important role in the development of the market in the past two decades. Given the increasing demand for financing, the bond market is expected to experience a rapid growth in the coming years. Huang and Zhu (2017) also discussed some areas with particular potentials and the challenges facing the development.

RENMINBI MARKET

The exchange rate of RMB to US dollar was fixed for many years. After China joined the WTO, its export and import volumes steadily increased. China also enjoyed trade surplus each year, leading to a large accumulation of foreign exchange reserves. The amount crossed over $1 trillion in 2006, over $2 trillion in 2009, and over $3 trillion in 2011. By 2014, it climbed to close to $3.84 trillion. Thereafter, the total amount declined to $3.12 trillion in 2016.

China began to peg the RMB to the dollar in 1994 at about 8.28 yuan per dollar and kept the rate constant through July 2005. Under pressure from its major trading partners, China moved to a managed peg system and began to allow the RMB to gradually appreciate over the next three years. As Table 1 shows, RMB appreciated from 8.2765 to 6.8596 by June 2008. In July 2008, China halted RMB appreciation because of the adverse effects of the global economic crisis on China's

exports. It resumed RMB appreciation in June 2010. From July 2005 through December 2013, the RMB appreciated by 27 percent. After 2013, China's current account surplus has declined, and its accumulation of foreign exchange reserves slowed (Morrison and Labonte. 2013). Thus, its currency has not continued to appreciate. Instead, it actually depreciated, from 6.0540 at yearend 2013 to 6.6534 in September 2017. Table 1 lists RMB/USD exchange rates from July 2005 to September 2017, at midyear and yearend.

Table 1. RMB Exchange Rates (RMB/USD)
Source: https://www.investing.com/currencies/usd-cny-historical-data.

DATE	EXCHANGE RATE
07/20/2005	**8.2765**
07/21/2005	8.1100
12/30/2005	**8.0702**
06/30/2006	7.9925
12/29/2006	**7.8075**
06/29/2007	7.6135
12/31/2007	**7.3041**
06/30/2008	6.8596
12/31/2008	**6.8230**
06/30/2009	6.8305
12/31/2009	**6.8270**
06/30/2010	6.7817
12/31/2010	**6.5906**
06/30/2011	6.4642
12/30/2011	**6.2939**
06/29/2012	6.3537
12/31/2012	**6.2303**
06/28/2013	6.1376
12/31/2013	**6.0540**
06/30/2014	6.2038
12/31/2014	**6.2061**
06/30/2015	6.2010
12/31/2015	**6.4936**
06/30/2016	6.6480
12/30/2016	**6.9450**
06/30/2017	6.6809
09/29/2017	**6.6534**

Prior to 2009, China permitted use of its currency only in Mainland China. The currency's unit of account is "Yuan". In July 2009, the Beijing government lifted restrictions to facilitate the development of an offshore RMB market in Hong Kong and elsewhere. It was the first time that RMB settlements were permitted outside Mainland China. The RMB in China is referred to as CNY and outside China as CNH.

The onshore CNY and offshore CNH are essentially the same currency. But, they could be traded at different levels. Each weekday morning, the PBOC sets a rate for CNY. The domestic market is then allowed to trade within 2 percent of this value. On the other hand, CNH's rate is not controlled. Its rate is determined by demand and supply in the foreign exchange market. But, due to PBOC's massive influence, this rate tends to stay within close range of the domestic CNY rate.

The next section covers investing in China onshore bond market. It outlines the structure of the bond market and the schemes for foreign investors to invest in China bonds. Section III provides a description of the data, summary statistics, correlation coefficients, and rolling annual correlation coefficients. Section IV provides a brief summary and concludes the paper.

INVESTING IN RENMINBI-DENOMINATED BONDS

International investors have traditionally faced restricted access to China bond market. The focus of this paper is on investing in the newly opened China onshore bond market. The new access provides foreign investors benefits of a higher return and a risk reduction in portfolio diversification. This section describes the onshore bond market and the ways international investors can invest in the market.

ONSHORE AND OFFSHORE BOND MARKETS

In the onshore bond market, maturities extend from 3 months to 50 years. However, the most liquid segment is 10 years or less. Commercial banks are the largest players, followed by insurance companies and mutual funds. Similar to other bond markets, a majority of bonds trade on the interbank bond market and the remaining, a small fraction, trade via the exchange. The interbank market is an over-the-counter market. The exchange market refers to the Shanghai and Shenzhen stock exchanges.

There are two major segments in the onshore market, the rates market and the credit market. The rates market accounts for 60 percent of the total and is mainly comprised of central government bonds (sovereign bonds), local government bonds, and policy bank bonds. The central government bonds are issued by the Ministry of Finance to fund central government operations. The so-called bills are issued by the PBOC (the central bank) to manage money market liquidity. Local governments issue local government bonds under a quota system approved by the State Council. Bonds issued by policy banks have historically received credit support from the central government. Investors, thus, treat policy bank bonds the same as sovereign bonds in terms of credit risk. The policy banks include China Development Bank, Agricultural Bank of China, and the

Export-Import Bank of China. The second segment, the credit market, includes bonds issued by non-government entities such as commercial banks, corporations, and non-bank financial institutions.

To track the performance of RMB denominated bonds, FTSE introduced the FTSE China Onshore Bond Index series (www.ftserussell.com). Those indexes are FTSE China Onshore Sovereign Bond Index, FTSE China Onshore Policy Bank Bond Index, and FTSE China Onshore Sovereign and Policy Bank Bond Index.

In the offshore bond market, dim sum bonds are issued outside of China but denominated in Chinese RMB. As such, foreign investors can gain exposure to RMB bonds without opening accounts in Mainland China. The offshore dim sum bond market is small. As such, it faces relatively low levels of liquidity and is mostly a retail market, rather than institutional market. One reason for this underdevelopment is a lack of transparency, as many bonds issued in this market are unrated. Also, offshore RMB bonds issued by Chinese firms are generally riskier than those issued by their multinational counterparts.

An example of the benchmark in this offshore market is Citi's Dim Sum Bond Index (available at www.yieldbook.com). The index includes fixed-rate securities issued by governments, agencies, supranationals, and corporations. Citi also publishes sub-indices in combination of asset class, maturity, or rating.

ACCESS TO CHINA ONSHORE BOND MARKET

The opening of China's onshore bond market offers global fixed-income investors higher yields and low correlations with other bond markets. As a result, global capital is likely to see a higher allocation to the Chinese market at the expense of other countries, including other emerging markets. The process will gain further strength with the inclusion of onshore Chinese bonds in global indexes. Foreign investors can invest in China's domestic bond market via one of several schemes. Those access schemes are discussed below.

QUALIFIED FOREIGN INSTITUTIONAL INVESTORS

In 2002, China launched Qualified Foreign Institutional Investors (QFII) scheme to allow qualified investors to enter China's capital market directly. Initially, the majority of the funds had to be invested in the stock market. Overtime, such restrictions have been relaxed. In addition, QFIIs were initially permitted to invest in exchange-listed bonds. They gained the right to trade in the interbank bond market in 2012. Foreign investors now have a more flexible asset allocation to invest the approved quota. By September 2017, State Administration of Foreign Exchange (SAFE) approved 287 QFIIs with a total amount of $94.5 billion. Those QFIIs include asset management companies, insurance companies, securities firms, commercial banks, pension funds, endowment funds, and sovereign wealth funds.

The QFII application process starts with the appointment of a custodian and then via the custodian submits the proposed investment plan to China Securities Regulatory Commission (CSRC). After CSRC approval, the custodian submits quota application to SAFE. With the approvals from CSRC and SAFE, the foreign investor opens special RMB and foreign exchange accounts. Within six months of the account opening, the investor must wire funds to the foreign account and then convert to local currency in the RMB account. After completing those steps, the investor can start investing. The approved products for QFIIs include A-shares, bonds, mutual funds, and exchange-traded funds.

RENMINBI QUALIFIED FOREIGN INSTITUTIONAL INVESTOR

Renminbi Qualified Foreign Institutional Investor (RQFII) scheme started in 2011. RQFII program allows Chinese financial firms to establish RMB-denominated funds in Hong Kong for investment in the mainland. The PBOC permitted RQFIIs to invest in the China interbank bond market in 2013. China has expanded the program to include qualified institutions from Singapore, United Kingdom, France, Korea, United States, and other countries. As of September 2017, China has approved 191 RQFIIs with a total amount of RMB 589.5 billion.

BOND CONNECT

China launched the Bond Connect program between the mainland and Hong Kong in June 2017. Qualified foreign investors are able to buy debt trading on China's interbank bond market directly through the Hong Kong exchange, a mirror of two stock connect facilities with domestic equity markets (Lau, et al., 2014). The two Stock Connect programs include the link between Shanghai and HK exchanges (2014) and Shenzhen and HK exchanges (2016). The Stock Connect programs aimed at creating a single China stock market that ranks among the largest in the world in terms of market capitalization and trading volume. Those qualified investors include foreign central banks, sovereign wealth funds, international financial organizations, QFIIs, RQFIIs, commercial banks, insurance companies, securities brokerage houses, and fund management companies. Under the Bond Connect program, northbound (Hong Kong to Mainland China) trading commenced on July 3, 2017. Southbound (Mainland China to Hong Kong) trading starts at a later date.

The Bond Connect program offers international investors greater levels of accessibility to China bonds of more than $9 trillion. This will impact their asset allocation strategies. The success of the program will depend on factors such as views on RMB, China's economy, credibility of bond ratings, and the yield curve compared to other markets. RMB appreciation is now not widely expected. The economic growth rate is still relatively high and expected to sustain in the near future. The yields of Chinese bonds are higher than those in other developed markets. After the roll out of the Bond Connect program, China also signaled that it would allow US rating agencies to enter the domestic bond market. This

will provide comfort to international investors, as they have now ratings based on international standards in their investment decision-making. As mentioned earlier, Chinese domestic rating agencies rarely rate bonds below AA- (Livingston, et al., 2017; FTSE Russell, 2017(b)).

In response to the deregulatory measures by Beijing government, index providers have moved to introduce China bond indexes and to include Chinese onshore bonds in emerging market bond indexes. For example, FTSE introduced China onshore bond index series (FTSE Russell, 2017(b)). Citi included Chinese onshore bonds in its three government bond indexes such as Emerging Markets Government Bonds Index, Asian Government Bond Index, and Asia Pacific Government Bond Index (Reuters, 03/07/2017). With the new Bond Connect program and inclusion of China bonds in fixed-income indices, large sums of additional fixed-income investments will be allocated to Chinese domestic bonds in the years to come.

DATA AND EMPIRICAL ANALYSES

FTSE launched China onshore bond indexes in March 2015, providing investors a set of benchmarks to measure the performance of the RMB-denominated bond market. Included in the indexes are fixed-rate and zero-coupon bonds issued by Chinese central government and policy banks. We used the following indexes in this study: (1) FTSE China Onshore Sovereign Bond Index, (2) FTSE China Onshore Policy Bank Bond Index, and (3) FTSE China Onshore Sovereign and Policy Bank Bond Index. To examine the benefits of diversification for fixed-income investors, we also included in the study the FTSE government bond market indexes in UK, France, Italy, Spain, Germany, and Eurozone. Table 2 lists the 9 indexes used in this study.

Table 2. Indexes

INDEX	SYMBOL USED IN FOLLOWING TABLES
FTSE Actuaries UK Conventional Gilts All Stocks Index	**UK**
FTSE China Onshore Policy Bank Bond 1-10 Year Index	CHNP
FTSE China Onshore Sovereign & Policy Bank Bond 1-10 Year Index	**CHNSP**
FTSE China Onshore Sovereign Bond 1-10 Year Index	CHNS
FTSE MTS Eurozone Government Index	**EUROZONE**
FTSE MTS Germany Index	FRANCE
FTSE MTS France Index	**GERMANY**
FTSE MTS Italy Index	ITALY
FTSE MTS Spain Index	**SPAIN**

Daily data covering the period from April 10, 2015 to the end of September 2017 are obtained from Bloomberg (at the Business Analytics Lab at St. John's University). The starting date is the earliest date that all daily data are available from Bloomberg. Table 3 presents summary statistics of daily returns. During the sample period, the three China bond indexes showed non-negative daily average returns (ranging from 0.000% to 0.002%) while all other indexes generated a small negative average daily returns (ranging from UK's -0.001% to Italy's -0.033%). In terms of volatility (as measured by standard deviation), China indexes are lower than all other indexes. The standard deviations for the three China indexes are all 0.0009%. For other indexes, Eurozone has the lowest standard deviation at 0.0024% and Spain has the highest at 0.0044%. Thus, the three China bond indexes (representing governments, policy banks, and governments and policy banks) provided investors better returns with lower risks.

Table 3: Summary Statistics
Data Source: Bloomberg

INDEX	AVERAGE DAILY RETURNS (%)	STANDARD DEVIATION
UK	**-0.001%**	**0.0041**
CHNP	0.002	0.0009
CHNSP	**0.002**	**0.0009**
CHNS	0.000	0.0009
EUROZONE	**-0.021**	**0.0024**
FRANCE	-0.018	0.0028
GERMANY	**-0.011**	**0.0026**
ITALY	-0.033	0.0041
SPAIN	**-0.025**	**0.0044**

We next review the correlation coefficients. As Table 4 shows, the correlation coefficients between each pair of UK, Eurozone, France, Germany, Italy, and Spain are all positive. The range is 0.171 (UK with Spain) to 0.940 (Eurozone with France). There are several correlation coefficients that are more than 0.800, including Eurozone with France, Eurozone with Germany, Eurozone with Italy, France with Germany, and Italy with Spain. Thus, many of the European index returns are highly correlated. On the other hand, the daily returns of the three China bond indexes post low correlations with UK and slight negative returns with all other indexes. If the returns relationships are linear, then investment allocations to China bond market will produce portfolio diversification benefits.

Table 4: Correlation Matrix of Daily Returns
Data Source: Bloomberg

INDEX	UK	CHNP	CHNSP	CHNS	EUROZONE	FRANCE	GERMANY	ITALY	SPAIN
UK	1.000								
CHNP	0.039	1.000							
CHNSP	0.031	0.948	1.000						
CHNS	0.015	0.730	0.907	1.000					
EUROZONE	0.584	-0.021	-0.031	-0.020	1.000				
FRANCE	0.663	-0.028	-0.046	-0.035	0.940	1.000			
GERMANY	0.736	-0.038	-0.047	-0.042	0.850	0.927	1.000		
ITALY	0.251	-0.005	-0.035	-0.022	0.824	0.633	0.458	1.000	
SPAIN	0.171	-0.016	-0.021	-0.001	0.746	0.519	0.364	0.849	1.000

To assess the correlation relationships over time, we performed rolling annual correlation analyses. The annual periods for calculating rolling correlation coefficients are:

1. 4/10/2015 – 3/31/2016
2. 7/1/2015 – 6/30/2016
3. 10/1/2015 – 9/30/2016
4. 1/1/2016 – 12/31/2016
5. 4/1/2016 – 3/31/2017
6. 7/1/2016 – 6/30/2017
7. 10/1/2016 – 9/30/2017

Table 5 reports the rolling correlation coefficients of China policy bank bond index with other indexes. During the first period (4/10/2015 – 3/31/2016), the correlation coefficients are all negative, except with UK. Thereafter, the correlation coefficients are positive, but low. The rolling correlation coefficients range from 0.033 (period 1/1/2016 – 12/31/2016, with Spain) to 0.200 (period 1/1/2016 – 12/31/2016, with UK).

Table 5: Rolling Annual Correlation Coefficients: CHNP With Other Indexes
Data Source: Bloomberg

CHNP WITH	4/10/2015-3/31/2016	7/1/2015-6/30/2016	10/1/2015-9/30/2016	1/1/2016-12/31/2016	4/1/2016-3/31/2017	7/1/2016-6/30/2017	10/1/2016-9/30/2017
UK	0.039	0.153	0.146	0.200	0.196	0.128	0.117
EUROZONE	-0.021	0.100	0.129	0.109	0.176	0.115	0.093
FRANCE	-0.028	0.097	0.107	0.112	0.169	0.096	0.083
GERMANY	-0.038	0.116	0.116	0.166	0.195	0.143	0.130
ITALY	-0.005	0.075	0.137	0.035	0.119	0.073	0.047
SPAIN	-0.016	0.036	0.090	0.033	0.123	0.087	0.048

Table 6 reports the rolling annual correlation coefficients of China government and policy bond index with other indexes. The results are similar to those showed in Table 5. During the first period (4/10/2015 – 3/31/2016), the correlation coefficients are all negative, except with UK. Thereafter, the correlation coefficients are positive, but the correlations are low. The correlation coefficients range from 0.030 (period 10/1/2016 – 9/30/2017, with Italy) to 0.215 (period 4/1/2016 – 3/31/2017, with Germany).

Table 6: Rolling Annual Correlation Coefficients: CHNSP With Other Indexes
Data Source: Bloomberg

CHNSP WITH	4/10/2015-3/31/2016	7/1/2015-6/30/2016	10/1/2015-9/30/2016	1/1/2016-12/31/2016	4/1/2016-3/31/2017	7/1/2016-6/30/2017	10/1/2016-9/30/2017
UK	0.031	0.126	0.127	0.203	0.211	0.139	0.134
EUROZONE	-0.031	0.080	0.121	0.128	0.188	0.122	0.098
FRANCE	-0.046	0.074	0.092	0.125	0.177	0.106	0.094
GERMANY	-0.047	0.088	0.095	0.173	0.215	0.165	0.156
ITALY	-0.035	0.042	0.114	0.046	0.121	0.062	0.030
SPAIN	-0.021	0.037	0.107	0.063	0.129	0.083	0.037

Table 7 reports the rolling annual correlation coefficients of China government bond index with other indexes. The results are again similar to those showed in Table 5 and Table 6. During the first period (4/10/2015 – 3/31/2016), the correlation coefficients are all negative, except with UK. Thereafter, the correlation coefficients are positive, but low. The correlation coefficients range from 0.005 (period 7/1/2015 – 6/30/2016, with Italy) to 0.241 (period 4/1/2016 – 3/31/2017, with Germany).

Table 7: Rolling Annual Correlation Coefficients: CHNS With Other Indexes
Data Source: Bloomberg

CHNS WITH	4/10/2015-3/31/2016	7/1/2015-6/30/2016	10/1/2015-9/30/2016	1/1/2016-12/31/2016	4/1/2016-3/31/2017	7/1/2016-6/30/2017	10/1/2016-9/30/2017
UK	0.015	0.086	0.092	0.210	0.229	0.154	0.161
EUROZONE	-0.020	0.051	0.100	0.162	0.198	0.120	0.095
FRANCE	-0.035	0.048	0.070	0.147	0.182	0.100	0.087
GERMANY	-0.042	0.055	0.070	0.196	0.241	0.189	0.182
ITALY	-0.022	0.005	0.085	0.066	0.116	0.052	0.016
SPAIN	-0.001	0.028	0.106	0.117	0.136	0.070	0.021

The rolling correlation coefficients in Tables 5 – 7 show that the negative correlations occurred during the first year of the sample period for all three China bond index returns with others, except with UK. Furthermore, the correlation relationships changed overtime, as evidenced by the changing rolling correlation coefficient from sample period to sample period. However, the rolling correlation coefficients are still negative or low. Thus, the benefits of portfolio diversification exist for the whole sample period or any sub-sample period.

CONCLUSIONS

China has the third largest bond market in the world. The offshore RMB bond market is relatively small. The onshore RMB bond market is huge and the new Bond Connect scheme opens up the market to foreign investors. From a portfolio management perspective, Chinese onshore bonds offer an attractive means for investors to diversify their fixed-income assets and reduce volatility of portfolio returns. The results showed that the three FTSE china onshore bond indexes offer higher average daily returns than other indexes. Those three index returns also had lower volatilities than other indexes in the sample. Furthermore, the China bond index returns showed negative or very low correlations with other government bond indexes across Europe (as shown by the overall correlation coefficients and the rolling correlation coefficients). This reflects the potential diversification benefits the Chinese onshore bonds offer to bond investors

Investing in China local bonds has challenges and risks as well. Domestic credit ratings are not the same as those from international agencies. In China, most issuers are only rated by local rating agencies and more than 70 percent of issuers are rated AA or better. Very few bonds are rated BBB or lower. Credit risk differentiation is thus a big concern. Entrance of international rating agencies will help, but it takes time.

We used bond indexes in this study. The discussions on the returns and benefits of portfolio diversification apply to investors using index-tracking products and exchange-traded funds. Our analyses are not aimed at investors seeking to select individual RMB bonds to outperform the onshore market. In such a case, the indexes can only be used to benchmark their performance and evaluate their ability to generate positive alpha.

The Bond Connect scheme started recently. This paper is an early attempt in academic literature to use the newly introduced China onshore bond indexes to examine the bond asset allocation implications. As the market develops, it is interesting for future research to look at how international fixed-income investors change their asset allocation strategies and how those changes impact on other emerging markets. In the future, it will also be helpful to examine China bond returns around rating changes, after international rating agencies have entered and applied rigorously the international standards.

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SOVEREIGN CREDIT DEFAULT SWAPS AND SYSTEMIC RISK

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ABSTRACT

This study examines the potential risk reducing benefits of sovereign credit default swaps (CDS) against systemic risk from 2006-2019. Tests of GARCH dynamic conditional correlation coefficients indicate that CDS serve as an effective hedge against systemic risk in 25 developed and emerging markets. CDS also provide a safe haven in times of extreme financial market volatility and during the 2008 global financial crisis.

INTRODUCTION

Sovereign credit default swaps (CDS) protect against the risk of a credit event such as a government bond restructuring or default. They are liquid financial products that can be traded in over-the-counter secondary markets, represent underlying sovereign credit risk, and react immediately to new public information. This paper uses GARCH dynamic conditional correlation (DCC) analysis to investigate a previously unstudied aspect of the CDS market: CDS indexes as a hedge and safe haven against systemic risk – the risk of financial system failures that commonly take place in the emerging markets.

We are motivated by the recent literature that documents the relationship between sovereign credit risk and systemic risk. Studies show that sovereign credit risk contains a systemic risk component associated with the financial market (Ejsing and Lemke (2011), Dieckmann and Plank (2012) and Ang and Longstaff (2013)). Since sovereign CDS offer protection against sovereign credit risk, the linkage implies that CDS could provide potential insurance benefits to investors against financial market turmoil.

While there is no definitive measure, bank stock returns are used as a proxy for systemic risk. Specifically, we measure systemic risk by using the bank indexes for the 25 countries in our sample. An increase (decrease) in bank index returns indicates a decrease (increase) in systemic risk (Acharya et al. (2010)). Following Baur and Lucey (2010) and Chiu and Ratner (2014), we define a hedge for

systemic risk as an asset that is negatively correlated with the bank stock indexes on average. In addition, we define a safe haven as an asset that is negatively correlated with the bank stock indexes during extreme market conditions.

We present three main findings in this study of return data in 25 countries. First, CDS are a hedge against systemic risk as evidenced by significantly negative correlations between CDS and bank stock returns. Second, in times of extreme financial market volatility, CDS are a safe haven in most countries. Third, CDS are generally a safe haven in most countries during the 2008 global financial crisis.

LITERATURE REVIEW

Identifying effective hedge and/or safe haven assets is important as financial crises occur frequently in the emerging markets and now plague developed countries as well. Additionally, the rising correlations between global markets negate some of the benefits of international investment, supporting the need for safe haven assets (Eun and Lee (2010)). Ejsing and Lemke (2011) and Dieckmann and Plank (2012) suggest that bank bailouts allow for risk transfer from financial markets to the sovereign entities during economic downturns. Ang and Longstaff (2013) show that sovereign credit risk contains a systemic risk component. Furthermore, they find that systemic risk is strongly linked to the financial markets. As an insurance against sovereign credit risk, CDS provide potential hedge and safe haven benefit against systemic risk.

The literature provides evidence that sovereign CDS are an effective measure of sovereign credit risk. Zhang (2008) finds that CDS capture the default risk of Argentinean sovereign bonds when the default risk is moderate. Delis and Mylonidis (2011) document that CDS Granger-cause the sovereign bonds of Greece, Italy, Portugal and Spain during the 2008 financial crisis. The authors indicate that high risk aversion affects the transmission mechanism between CDS and government bonds

Our paper examines the efficacy of CDS to hedge against systemic risk. Reinhart and Rogoff (2011) define a systemic event as "bank runs that lead to the closure, merging, or takeover by the public sector of one or more financial institutions." Billio et al. (2012) characterize it as "any set of circumstances that threatens the stability of or public confidence in the financial system." Generally, systemic risk is the risk of financial system failure that could lead to disruptions or even collapse of the real economy.

Systemic risk events arise in several ways. The business cycle and financial panic are possible sources of systemic events (Allen and Gale (1998) and Diamond and Dybvig (1983)). Contagion, the failure of one bank quickly spreading to other banks, is a major contributor to the failure of the interbank market during the recent global financial crisis (European Central Bank (2009)).

Given the complex nature of systemic risk, several measures of systemic risk exist in the literature. Bisias et al. (2012) categorize the measures by research methods, including macroeconomic measures (Alessi et al. (2011)) and default measures (Huang et al. (2012)). In this paper, we define systemic risk as the decline in bank stock indexes. Similar to Huang et al. (2012), we use the dynamic conditional correlations technique in Engle (2002).

METHODOLOGY

It is well established in the literature that financial asset returns in time series are dependent on past volatilities and return shocks (Bollerslev (1990)). While imperfect correlation between investment returns is critically important for portfolio risk reduction, the assumption of constant correlation over time is rejected for many financial assets (Bera and Kim (2002)). Many researchers compensate for time-variant correlations by using "rolling regression" or "exponential smoothing" techniques. While valuable in some circumstances, both of these techniques suffer from weaknesses (Engle (2002)).

Dynamic conditional correlation (DCC) is a technique developed by Engle (2002) to examine time series with non-constant correlation. The procedure uses GARCH to generate time-varying estimates of the conditional co-movement between assets. The first order univariate GARCH models are estimated for the CDS returns and bank stock indexes of each country using the Glosten et al. (1993) model allowing for asymmetries:

$$h_t = c_0 + a_1\varepsilon_{t-1}^2 + b_1 h_{t-1} + d_1\varepsilon_{t-1}^2 I_{t-1} \qquad (1)$$

where h_t is the conditional variance, d_1 is the asymmetry term, and $I_{t-1}=1$ if $\varepsilon_t<0$, otherwise $I=0$.

The correlation component ρ_t is maximized as follows:

$$\rho_t = (1-\alpha-\beta)\bar{\rho} + \alpha\varepsilon_{t-1}\acute{\varepsilon}_{t-1} + \beta\rho_{t-1} \qquad (2)$$

where the values of the DCC parameters α and β are provided. If α and β are zero, then ρ_t reduces to $\bar{\rho}$, which would indicate that the constant correlation model is appropriate.

Once the DCC coefficients are extracted from model (2) into a separate time series for each market, the effectiveness of CDS to serve as a hedge and safe haven asset is examined as:

$$\rho_{c,b,t} = \gamma_0 + \gamma_1 D(r_{bank\ index} q_{10}) + \gamma_2 D(r_{bank\ index} q_5) + \gamma_3 D(r_{bank\ index} q_1) \quad (3)$$

where $\rho_{c,b,t}$ is the dynamic conditional correlation between CDS and the bank index returns. *D* represent dummy variables that capture extreme movements in the underlying bank index at the 10%, 5%, and 1% quantiles. CDS function as a hedge if γ_0 is negative for the individual market. CDS are a safe haven if the γ_1, γ_2, or γ_3 coefficients are significantly negative. The dummy variable regression is loosely based on Baur and McDermott (2010) who utilize time varying betas calculated from rolling regression.

We examine the ability of CDS to serve as a hedge and/or safe haven during a period of financial crisis using a modified model based on Chiu and Ratner (2018):

$$\rho_{c,b,t} = \gamma_0 + \gamma_1 D(Global\ Crisis) \quad (4)$$

where a dummy variable is set to one during the recent global financial crisis period (09/2008).

Identification of financial crises is subjective since there is no one specific defining event or date that separate the crisis period from the normal period. The dummy variable is set to one during the financial market crisis experienced by each individual market. Following the contagion literature suggested by Forbes and Rigobon (2002), the duration is one month for the crisis period. CDS function as a hedge if γ_0 is significantly negative for the individual markets. CDS are a safe haven if the γ_1 coefficient is significantly negative.

We also examine the systemic risk using the Large, Complex Bank Holding Companies (LCBHC) stock returns. LCBHC in our portfolio include the financial institutions identified in the Board of Governors of the Federal Reserve System (2011). LCBHC are the bank holding companies that pose the greatest threat to the financial system:

$$\rho_{c,l,t} = \gamma_0 + \gamma_1 D(r_{LCBHC} q_{10}) + \gamma_2 D(r_{LCBHC} q_5) + \gamma_3 D(r_{LCBHC} q_1) \quad (5)$$

where $\rho_{c,l,t}$ is the dynamic conditional correlation between CDS and the LCBHC stock returns. *D* represent dummy variables that capture extreme movements in the underlying LCBHC stock returns at the 10%, 5%, and 1% quantiles.

DATA

The countries in the sample include both developed and emerging markets. The data consist of CDS and bank indexes of 25 countries from Datastream. The bank index for each country is defined by the FTSE Industry Classification Benchmark (ICB). The indexes are weighted by market capitalization, contain the largest banks in each country, and represent close to 80% of the total market capitalization. CDS index data consist of midmarket prices for 5-year contracts for each country. While CDS are largely available for bonds in the 1-5 year and 10-year maturities, the 5-year CDS are the most liquid and active market (Palladini and Portes (2011)). The data period spans from October 2006 to July 2019 with daily frequency. The country bank indexes are quoted in local currency. Hence, the paper takes the perspective of local investors for the country indexes. Bank stock index prices are total returns including dividends. To achieve stationarity all data are transformed into first-difference form.

Table 1 reports the means and standard deviations of daily returns for the CDS and bank indexes. Daily mean CDS returns are highest in Greece (0.091%) and lowest in Thailand (-0.004%). Standard deviation is highest in Ireland (14.979%) and lowest in Turkey (3.256%). Among the country bank indexes, Argentina has the highest mean return (0.113%) and Greece has the lowest mean return (-0.241%). Ireland (4.279%) has the highest standard deviation whereas Malaysia (0.812%) has the lowest standard deviation. The divide between developed markets and emerging markets is not definitive. Not all bank indexes compensate investors with positive mean returns. For example, Greece has a mean return of -0.241% and a standard deviation of 4.186%.

Table 1: Descriptive Statistics for Daily Returns on Sovereign Credit Default Swaps and Country Bank Indexes, October 2006 to July 2019

		CREDIT DEFAULT SWAPS		BANK INDEXES	
MARKETS	OBS.	MEAN (%)	STD. DEV. (%)	MEAN (%)	STD. DEV. (%)
ARGENTINA	3327	0.041	5.001	0.113	2.152
AUSTRALIA	3327	0.022	5.793	0.026	1.385
AUSTRIA	3327	0.047	9.609	-0.009	2.197
BELGIUM	3327	0.058	4.138	-0.025	2.627
BRAZIL	3327	0.003	3.716	0.051	1.848
CHILE	3327	0.014	3.938	0.047	0.984
CHINA	3327	0.025	3.925	0.031	1.684
FRANCE	3327	0.047	9.407	-0.013	2.306
GERMANY	3327	0.043	8.771	-0.056	2.206
GREECE	3327	0.091	8.029	-0.241	4.186
IRELAND	3327	0.066	14.979	-0.117	4.279
ITALY	3327	0.072	4.053	-0.036	2.312
JAPAN	3327	0.052	10.731	-0.024	1.781
KOREA	3327	0.002	3.947	0.000	1.880
MALAYSIA	3327	0.022	3.881	0.035	0.812
MEXICO	3327	0.028	3.793	0.037	1.349
NETHERLANDS	3327	0.056	13.958	-0.078	3.070
PORTUGAL	3327	0.043	4.359	-0.085	2.332
RUSSIA	3327	0.022	3.857	0.028	2.296
S. AFRICA	3327	0.032	3.369	0.049	1.644
SPAIN	3327	0.062	5.344	-0.013	2.056
THAILAND	3327	-0.004	3.778	0.029	1.515
TURKEY	3327	0.019	3.256	0.032	2.035
U.K.	3031	0.041	3.760	-0.015	1.977
U.S.	3031	0.016	7.206	0.011	2.397

Note: All values are in local currency.

EMPIRICAL RESULTS

DYNAMIC CONDITIONAL CORRELATION

Table 2 reports the descriptive statistics of the DCC coefficients for each country's CDS index against its bank index. All countries have negative mean DCC. The lowest mean DCC coefficient occurs in Turkey (-0.509). Ireland and the U.S. (0.019) experience the smallest standard deviation in the DCC coefficients, while Greece (0.203) has the highest standard deviation. We define a hedge for systemic risk as an asset that is negatively correlated with the bank indexes on average. The negative mean DCC coefficients in Table 2 imply that CDS are a hedge in all 25 countries.

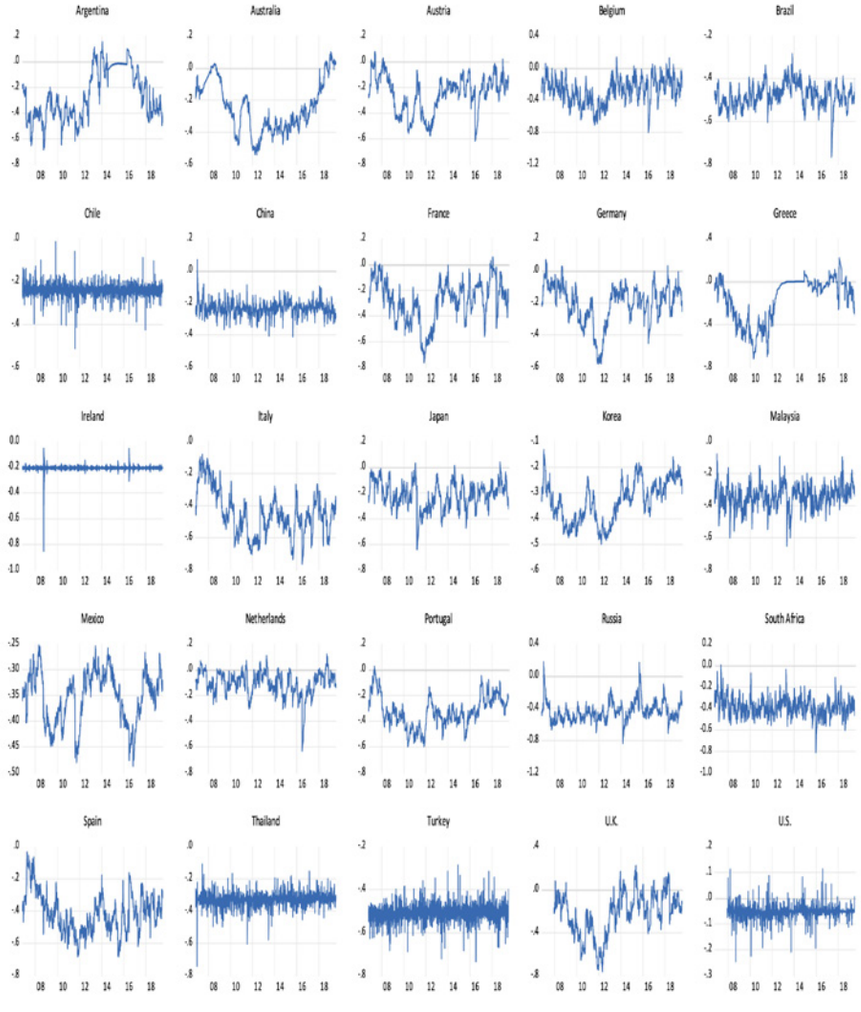
Table 2: Mean Daily Dynamic Conditional Correlations for Returns on Sovereign Credit Default Swaps and Country Bank Indexes, October 2006 to July 2019

	OBS.	MEAN		STD. DEV.	MIN.	MAX.
ARGENTINA	3327	-0.262	***	0.192	-0.684	0.152
AUSTRALIA	3327	-0.242	***	0.156	-0.539	0.099
AUSTRIA	3327	-0.250	***	0.144	-0.618	0.075
BELGIUM	3327	-0.281	***	0.160	-0.802	0.131
BRAZIL	3327	-0.478	***	0.054	-0.766	-0.285
CHILE	3327	-0.241	***	0.021	-0.511	-0.017
CHINA	3327	-0.234	***	0.042	-0.408	0.067
FRANCE	3327	-0.283	***	0.163	-0.763	0.054
GERMANY	3327	-0.204	***	0.123	-0.577	0.067
GREECE	3327	-0.159	***	0.203	-0.719	0.218
IRELAND	3327	-0.207	***	0.019	-0.853	-0.054
ITALY	3327	-0.450	***	0.139	-0.761	-0.083
JAPAN	3327	-0.218	***	0.104	-0.639	0.040
KOREA	3327	-0.333	***	0.079	-0.498	-0.132
MALAYSIA	3327	-0.343	***	0.071	-0.650	-0.080
MEXICO	3327	-0.353	***	0.050	-0.487	-0.252
NETHERLANDS	3327	-0.107	***	0.096	-0.631	0.120
PORTUGAL	3327	-0.325	***	0.121	-0.598	0.024
RUSSIA	3327	-0.441	***	0.123	-0.833	0.178
SOUTH AFRICA	3327	-0.389	***	0.087	-0.810	0.003
SPAIN	3327	-0.411	***	0.122	-0.683	-0.035
THAILAND	3327	-0.328	***	0.034	-0.741	-0.110
TURKEY	3327	-0.509	***	0.028	-0.735	-0.287
U.K.	3031	-0.222	***	0.199	-0.759	0.221
UNITED STATES	3031	-0.053	***	0.019	-0.245	0.112

Note: We also include the standard deviations, minimums, and maximums of the dynamic conditional correlations.
**** indicates significance at the 1% level.*

Table 3 shows the DCC coefficients of the U.S. CDS and bank indexes over time. The correlations are largely negative over the entire sample period indicating that CDS are frequently a hedge. Notably, the DCC coefficients are highly negative during the global financial crisis between 2008 and 2009.

Table 3: Daily Dynamic Conditional Correlations on Sovereign Credit Default Swaps and Country Bank Indexes, October 2006 to July 2019.



SAFE HAVEN ANALYSIS

While CDS appear to be a hedge for systemic risk in Table 2, a safe haven asset offers protection during financial crises or economic turmoil when banks experience extreme stress. Table 4 shows the estimates of safe haven analysis based on model (3) using daily data. The DCC coefficients are regressed on a constant and three dummy variables representing levels of extreme bank index returns at quantiles of 10%, 5% and 1%. The hedge column indicates a negative relationship between CDS and bank indexes.

Table 4: Regression Coefficients of Sovereign Credit Default Swaps (CDS) as a Hedge and Safe Haven against Country Bank Index Daily Returns

			BANK INDEX QUANTILE					
MARKETS	HEDGE		10%		5%		1%	
ARGENTINA	-0.392	***	0.010	***	0.012	***	-0.016	***
AUSTRALIA	-0.335	***	-0.004	***	0.006	***	0.015	***
AUSTRIA	-0.211	***	-0.006	***	-0.009	***	-0.043	***
BELGIUM	-0.266	***	0.003		-0.007		0.035	***
BRAZIL	-0.488	***	0.000		0.002		0.016	***
CHILE	-0.241	***	0.002		-0.003		-0.009	***
CHINA	-0.234	***	0.003	***	0.002		-0.003	
FRANCE	-0.258	***	0.000		0.015	***	-0.011	***
GERMANY	-0.151	***	0.001		-0.008	***	0.009	***
GREECE	-0.003	***	0.000		-0.003	**	0.005	**
IRELAND	-0.206	***	0.001	***	0.000		0.006	***
ITALY	-0.464	***	0.008	***	0.000		0.013	**
JAPAN	-0.219	***	0.000		0.006	*	-0.030	***
KOREA	-0.319	***	0.002	*	0.002		-0.017	***
MALAYSIA	-0.340	***	-0.002		0.008	***	-0.016	***
MEXICO	-0.337	***	0.001		0.006	***	-0.034	***
NETHERLANDS	-0.088	***	0.000		-0.009	***	0.014	***
PORTUGAL	-0.345	***	0.003		0.002		0.000	
RUSSIA	-0.456	***	-0.001		0.009	***	0.056	***
SOUTH AFRICA	-0.405	***	-0.005	**	0.012	***	-0.066	***
SPAIN	-0.419	***	0.006	***	0.003		0.008	**
THAILAND	-0.326	***	-0.004		-0.017	***	-0.032	***
TURKEY	-0.508	***	0.000		-0.010	***	-0.031	***
UK	-0.148	***	-0.011	***	0.019	***	0.010	*
US	-0.052	***	0.001		0.010	***	0.008	***

*Note: The significantly negative coefficients in the hedge and/or bank index quantile columns indicate that CDS are a hedge and/or safe haven against systemic risk. ***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.*

At extreme levels of systemic risk, CDS have some ability to function as a safe haven asset. At the 10% quantile, the regression coefficients for Australia (-0.004), Austria (-0.006) and the U.K. (-0.011) are negative and significant at the 1% level and for South Africa (-0.005) is negative and significant at the 5% level. CDS offer a safe haven at the more extreme 5% quantile for Austria (-0.009), Germany (-0.008), the Netherlands (-0.009), Thailand (-0.017) and Turkey (-0.010) at the 1% level of significance, while Greece (-0.003) is significant and negative at the 5% level. Argentina (-0.016), Austria (-0.043), Chile (-0.009), France (-0.011), Japan (-0.030), Korea (-0.017), Malaysia (-0.016), Mexico (-0.034), South Africa (-0.066), Thailand (-0.032) and Turkey (-0.031) are negative and significant at the 1% level for the most extreme 1% quantile.

As a robustness test, we examine whether CDS serve as either a hedge and/or safe haven during a major financial crisis. The test is based on the recent global financial crisis following model (4), and the results are presented in Table 5.

Table 5: Regression Coefficients of Sovereign Credit Default Swaps as a Safe Haven against Systemic Risk During the Global Financial Crisis (September 2008)

MARKETS	HEDGE	GLOBAL FINANCIAL CRISIS		
ARGENTINA	-0.396	***	-0.070	***
AUSTRALIA	-0.334	***	0.271	***
AUSTRIA	-0.233	***	0.086	***
BELGIUM	-0.267	***	-0.058	***
BRAZIL	-0.481	***	-0.049	***
CHILE	-0.241	***	-0.013	***
CHINA	-0.233	***	-0.029	***
FRANCE	-0.256	***	-0.121	***
GERMANY	-0.154	***	0.122	***
GREECE	-0.003	***	-0.385	***
IRELAND	-0.206	***	0.049	***
ITALY	-0.461	***	0.118	***
JAPAN	-0.221	***	0.140	***
KOREA	-0.318	***	-0.088	***
MALAYSIA	-0.341	***	0.020	**
MEXICO	-0.337	***	0.013	***
NETHERLANDS	-0.103	***	-0.081	***
PORTUGAL	-0.339	***	-0.016	***
RUSSIA	-0.465	***	-0.090	***
SOUTH AFRICA	-0.400	***	-0.050	***
SPAIN	-0.419	***	-0.106	***
THAILAND	-0.327	***	-0.040	***
TURKEY	-0.507	***	-0.022	
U.K.	-0.151	***	0.018	**
U.S.	-0.053	***	-0.048	***

*Note: The significantly negative coefficients in the crisis period columns indicate that CDS are a safe haven. ***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.*

Consistent with Table 4, CDS serve as a hedge for all markets indicated with negative coefficients. The significantly negative coefficients suggest that CDS serve as a safe haven during the most recent global financial crisis. CDS provide a safe haven in 15 countries including Argentina (-0.070), Belgium (-0.058), Brazil (-0.049), Chile (-0.013), China (-0.029), France (-0.121), Greece (-0.385), Korea (-0.088), the Netherlands (-0.081), Portugal (-0.016), Russia (-0.090), South Africa (-0.050), Spain (-0.106), Thailand (-0.040) and the U.S. (-0.048). The significance of results reflects the global nature of the 2008 financial crisis, and the increasing importance of managing systemic risk.

LCBHCs

Large, complex bank holding companies (LCBHCs) are financial intermediaries with the greatest potential threat to the banking system. Table 6 presents the hedging and safe haven properties of CDS based on a portfolio of LCBHC stock returns as a proxy for systemic risk.

The results show that CDS are a hedge against LCBHC stock returns. At the 10% quantile, the regression coefficients are negative and significant in five countries, while at the 5% and 1% quantiles, the coefficients are negative and significant in four and six countries respectively. Overall, Table 6 confirms our prior findings.

Table 5: Regression Coefficients of Sovereign Credit Default Swaps as a Safe Haven against Systemic Risk During the Global Financial Crisis (September 2008)

			LCBHC QUANTILE					
MARKETS	HEDGE		10%		5%		1%	
ARGENTINA	-0.262	***	0.000		0.018	***	0.002	
AUSTRALIA	-0.064	***	0.000	***	0.000	***	0.000	***
AUSTRIA	-0.171	***	0.003		0.003		0.013	***
BELGIUM	-0.221	***	0.001	***	0.001	***	-0.008	***
BRAZIL	-0.439	***	0.004	***	0.014	***	0.000	
CHILE	-0.239	***	0.001		0.017	***	0.011	
CHINA	-0.193	***	0.000		0.000		0.001	
FRANCE	-0.187	***	-0.002	**	-0.006	***	0.008	**
GERMANY	-0.129	***	0.003	***	0.017	***	-0.010	***
GREECE	-0.041	***	0.003	***	-0.023	***	0.038	***
IRELAND	-0.184	***	-0.003	***	0.006	***	0.014	***
ITALY	-0.277	***	0.000		0.005	***	0.013	
JAPAN	-0.067	***	0.008	***	-0.001		-0.008	***
KOREA	-0.189	***	0.002	***	-0.008	***	0.008	***
MALAYSIA	-0.174	***	0.003	***	0.001		0.008	***
MEXICO	-0.411	***	0.004	***	-0.001		-0.003	
NETHERLANDS	-0.111	***	-0.005	***	0.015	***	-0.013	***
PORTUGAL	-0.192	***	-0.005	***	0.004	*	-0.043	***
RUSSIA	-0.275	***	0.001		-0.002		0.004	
SOUTH AFRICA	-0.294	***	0.003	***	-0.006	***	-0.003	
SPAIN	-0.242	***	0.002	*	-0.001		0.008	
THAILAND	-0.151	***	-0.001		0.002	***	0.009	***
TURKEY	-0.349	***	0.001		0.003	***	-0.003	**
U.K.	-0.159	***	-0.001	*	0.004	***	0.005	
U.S.	-0.045	***	0.004	***	0.005	***	0.008	***

*Note: The significantly negative coefficients in the hedge column indicate that CDS are a hedge against systemic risk. The significantly negative coefficients in the LCBHC quantile indicate that CDS are a safe haven against systemic risk during periods of extreme volatility. ***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.*

CONCLUSIONS

This paper evaluates the hedging and safe haven properties of sovereign credit default swaps (CDS) against the systemic risk of 25 countries from October 2006 to July 2019. Dynamic conditional correlations indicate that rising CDS prices are associated with falling bank index prices. Dummy variable regressions representing levels of extreme bank index returns provide evidence that CDS are a hedge against systemic risk in all of the sample countries. During extreme moves in the underlying bank indexes, CDS provide a safe haven against systemic risk in most countries. Additional tests show CDS serve as a safe haven during the global financial crisis in 15 countries. Lastly, to illustrate the benefits of CDS as a hedge against systemic risk, we also analyze the Large, Complex Bank Holding Companies (LCBHC) stock returns. Consistent with prior results, CDS are a hedge and demonstrate various safe haven characteristics against the LCBHC stock returns.

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REVISITING ARCELOR'S TAKEOVER BY MITTAL STEEL: CHANGING GOVERNANCE AND CULTURAL BIAS

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ABSTRACT

The hostile takeover of Arcelor by Mittal Steel highlights the changes in governance, the market for corporate control, and mechanism for hostile takeovers that occurred in the last two decades in continental Europe. The course of the takeover can serve as a valuable lesson for practitioners in emerging markets. To illustrate these changes, this paper discusses the differences in governance and corporate control between the United States and Europe, the evolution of the market for corporate control, and changes in the mechanics for hostile takeovers. We then examine how these changes enabled and informed the course of the hostile takeover of Arcelor by Mittal Steel.

INTRODUCTION

In the United States, the ownership of most firms that are listed in stock exchanges is dispersed among small shareowners. As a consequence, corporate control of these firms lies mostly with their managers. Because of this separation of ownership and control, corporate governance in the U.S. has focused primarily on the problem of alleviating the conflict of interest that can occur between shareholders and powerful management (Jensen & Meckling, 1976).

In Continental Europe, on the contrary, fewer of the firms that are listed in stock exchanges are widely held by small shareowners (Enriques and Volpin; 2007). Instead, most of the firms that are listed in stock exchanges in Continental Europe (and indeed around the world) have one (or a small number of) dominant shareholder(s) —usually an individual or a family—who control the voting majority. Often, this controlling shareholder exercises control through the use of pyramidal ownership, shareholder agreements, and dual classes of shares. Pyramidal ownership (or *pyramidal control*) is defined as the ownership structure in which the controlling shareholder exercises control of one

listed firm through control in at least one other listed firm (La Porta, Shleifer, & Lopez-de-Silanes, 1999).

A dominant shareholder or *controlling shareholder* is commonly defined as one that owns at least 20% of the voting rights of the listed firm. Such concentrated ownership has two consequences for corporate governance. First, it gives the dominant shareholders the incentive (and the necessary power) to align the interests of management and shareholders. This eliminates the potential of conflicts of interest between shareholders and managers that are common in firms that are widely held by small shareholders. Secondly, it can create a new conflict of interest between the controlling and minority shareholders (Enriques & Volpin, 2007).

Barontini and Caprio (2005) argued that family-controlled firms in continental Europe are, on average, better managed than widely held firms. However, Enriques and Volpin (2007) counter that these findings do not guarantee that family-controlled firms are always better governed than widely held ones. Family control helps protect shareholders interest against managerial abuse, however families (like managers in widely held firms) can abuse their power and use corporate resources to their own advantage. A common practice is *self-dealing* or *tunneling*: where the family control over the firm is enacted via a pyramidal control structure. By this practice, value is transferred higher up in the pyramid, so that the controlling shareholders own a larger fraction of the firm's cash-flow rights.

The power of controlling shareholders to guarantee the firm's performance (by supervising management on the positive side; and by the use corporate resources for their advantage in the negative side) is probably the most important reason for why the value of a firm is higher for them than for other minority shareholders. The higher value of the controlling shareholders' block of shares is commonly called *control block premium*, and this represents the difference between the price per share in a sale of the control block transaction and the market price of the shares after the transaction. Another measure of the value of corporate control is the *voting premium*, which is the difference between the market price of voting and non-voting shares.

Contemporary corporate governance in Europe is based on the principles raised in two documents: "The Cadbury Report" (Cadbury, 1992), and "The OECD Principles of Corporate Governance" (Johnston, 2004). These reports present general principals around which businesses are expected to operate to assure proper governance. Based on these principles, France, Germany, and Italy have introduced, in the last 20 years, corporate law reforms to strengthen corporate governance, empower shareholders, and enhance disclosure requirements. Because most continental European firms have controlling shareholders, special emphasis was placed in these reforms to empower minority shareholders and on disclosure, to curb possible abuses from dominant shareholders (Enriques & Volpin, 2007).

The purpose of this paper is to re-examine the takeover battle of Mittal Steel (the acquiror) and Archelor (the target). Archelor resisted the takeover bid using common tactics such as a poison pill as a defensive tool. They also tried to use political influence that they could muster in Europe which, similar to many emerging market governments, are keen to protect their key companies. Lessons learned from this takeover battle can be readily served as a valuable learning tool for practitioners who are interested in M&A in both European and emerging markets.

MARKET FOR CORPORATE CONTROL

Jensen and Ruback (1983) defined the market for corporate control as "the market in which alternative management teams compete for the right to manage corporate resources." They called it "an important component of the managerial labor market." They reasoned that if the management team of a listed firm is failing to give the best return to its shareholders (and is consequently undervaluing their shares in the market) it could be replaced by a more competent management team of another firm. The acquiring firm's management team could offer a significant premium for the undervalued shares of the firm that they are acquiring, and then after the acquisition make the necessary improvements in its performance to justify the purchase premium.

Shareholders of both the target firm and acquiring firm tend to gain from such an acquisition. The acquired shareholders receive a substantial premium for their shares and the acquiring shareholders benefit from the improved performance of acquired firm plus synergies. These benefits, obviously, only occur if the premium paid was not excessive, and did not consume all potential benefits of the acquisition (Martynova & Renneboog, 2005, 2006, 2011).

Viewing the market for corporate control as being only for underperforming listed firms is a gross simplification. There are many other motives for the acquisition of listed firms by other firms, including: improving the strategic position, acquiring technology, increasing market share, and operational synergies (Trautwein, 1990). However, the basic principle for the premium price paid for the acquired listed firms shares does not change. The premium paid for the shares has to be justified by the increase in value of the acquiring firm.

TAKEOVERS IN CONTINENTAL EUROPE

Takeovers in Continental Europe had grown from a negligible number of transactions in the early 1980s to a significant number by the end of the decade. However, only starting in the 90s did Continental European firms begin to participate aggressively in takeovers (see Figure 1). Factors that are commonly attributed to the intensive participation of Continental European firms in the takeover waves of the 1990s and the 2000s include: the introduction of the euro, the globalization process, technological innovation, deregulation and

privatization, shareholder activism, the boom in the financial markets (particularly the availability of low cost financing), and the growth of private equity and hedge funds (Martynova & Renneboog, 2005, 2006, 2011; Lipton, 2006).

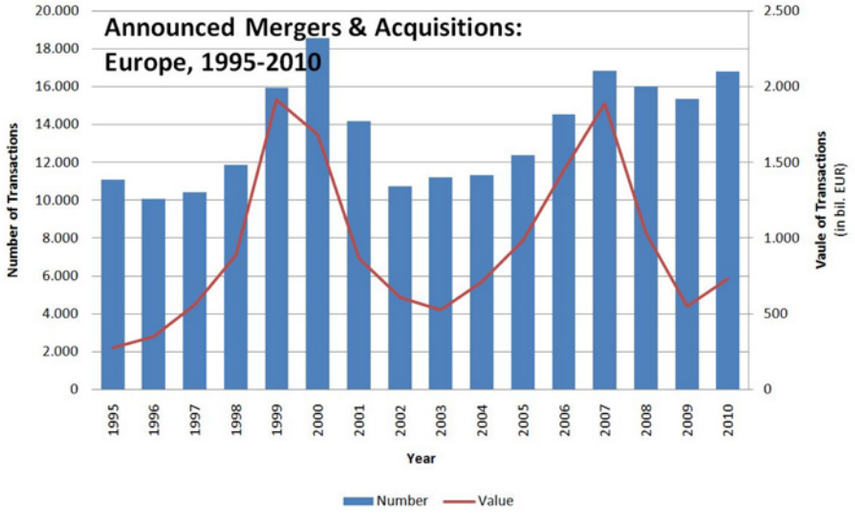

Figure 1: The European takeover waves of the 1990s and of the 2000s
Source: Institute of Mergers, Acquisitions, and Alliances

Most of the takeovers in Continental Europe (both horizontal and vertical ones) involved firms in related industries (Martynova & Renneboog, 2005, 2006, 2011). This trend of consolidating industries started in the 1980s and became predominant by the 2000s as firms focused on promoting the growth of their core business.

Martynova and Renneboog (2005, 2006, 2011) have noted that the considerable financial resources required for growth via takeovers has forced many cash-constrained firms to finance their acquisitions with equity or a combination of equity and debt. They suggested that the boom in the stock market that began in the second half of the 1990s increased the attractiveness of equity as a means of payment for acquisitions. At the same time, the European market for corporate bonds grew rapidly and provided another accessible source of funds for acquiring firms. Additionally, the banks' growing appetite for more risky loans and the low interest rate environment also fueled the takeover activities.

POLITICS AND HOSTILE TAKEOVERS

Hostile takeovers are considered to be a standard business practice in the United States and in the United Kingdom. In these two counties, firms can freely change control without many restrictions (except for antitrust laws): they have what is commonly known as an *active market for corporate control* (Culpepper, 2011).

In contrast, Continental Europe is commonly viewed as a *passive market for corporate control*. In most continental European countries political and business leaders collude to prevent large firms from being treated as disposable assets (Culpepper, 2011). This approach is based on an argument that hostile takeovers are a negative aspect of poorly regulated capitalism and that the conquered firms are open to being ransacked, reorganized, or even liquidated, with grim consequences for employees and communities. Awareness of this argument has often allowed the management of target firms in Continental Europe to mobilize enough political support to neutralize any attempt of hostile takeover. This phenomenon is also common in emerging markets with their desire to protect domestic industries.

As a consequence of these political barriers, hostile takeovers were rare in Continental Europe prior to the 1980s. With the deregulation of the capital markets, however, these institutional arrangements that had formerly impeded hostile takeovers began to dismantle. Anglo-American pension and hedge funds with cheap and abundant capital began raising their ownership stakes in many continental European firms. In exchange, they demanded political and firm-level reforms to improve governance and consequently corporate performance (Culpepper, 2011).

Shareholder activism pioneered by institutional investors and hedge funds in the United States used the proxy process and other approaches to pressure management to change (Ferreira, Massa, & Matos, 2010). Shareholder activism primarily focuses on increasing shareholders value through changes in corporate policy, financial structure, cost-cutting or divestment, and adopting more aggressive environmental policies. When institutional investors and hedge funds entered the Continental European market during the 1980s, they introduced U.S. style shareholder activism to continental Europe.

Enriques and Volpin (2007) show that lawmakers in Continental Europe have responded to shareholder activism and have taken various steps to increase the powers of minority shareholders vis-à-vis managers and dominant shareholders. Minority shareholders now have the power to authorize or ratify some transactions and resolutions in potential conflicts of interest. To limit the power of controlling shareholders, special majorities for non-routine shareholders resolutions have been put in place and the regulatory framework for disclosure has been improved. Additionally, the cost of voting has been reduced and firms can now allow remote voting (via the internet).

TAKEOVER OF ARCELOR BY MITTAL STEEL

The successful takeover bid by Mittal Steel (a company that had overtaken in 2005 Arcelor to become the number one steel producer in the world) for Arcelor in 2006 is a landmark in many respects (see Figure 2). The takeover illustrates the changes in governance, market for corporate control, and the mechanisms for hostile takeovers that have occurred in the last decade in Continental Europe, motivated by strong shareholder activism. It can also serves as a lesson for takeovers in emerging markets. Arcelor was a typical Central European firm with strong ties to local government, which supported management in detriment to the shareholders' return. The excuse was that the economic and social importance of the company as employer and its contribution to the country's economy was more important that increasing value for shareholders.

Firm	2004		2005	
	Position	Production	Position	Production
Mittal Steel	2	42.8	1	63.0
Arcelor	1	46.9	2	46.7
Nippon Steel	3	32.4	3	32.0
POSCO	5	30.2	4	30.5
JEE Steel	4	31.6	5	29.9
Shanghai BoaSteel	6	21.4	6	22.7
US Steel	7	20.8	7	19.3

Figure 2: Top steel-producing firms in 2004 and 2005 in million metric tons crude steel output. Taken from *The Steel War: Mittal vs. Arcelor* (Case) by I. Walter & A. M. Carrick, 2007. Copyright 2007 by INSEAD.

ARCELOR'S TIES TO LUXEMBURG

After the discovery in 1843 of rich iron ore deposits in Luxemburg, the steel industry became the major force in the country's development until the 1974 steel industry crisis. The steel industry in Luxemburg was the main contributor for the country's GDP and its largest employer. After a series of mergers at the beginning of the 20th century, the steel firm Arbed was formed (Walter & Carrick, 2007; Goralski, 2009).

The firm was restructured after the oil crisis in the 1970s and some of its underperforming plants were closed and others were modernized. The number of employees was gradually reduced: from almost 30,000 in 1974 to just 5000 in 1998. Due to the importance of Arbed to Luxemburg's economy, the government saved it from bankruptcy in 1982 by becoming a 30% shareholder in a recapitalization. To cover the cost of the bailout, Luxemburg's taxpayers were subject to a 10% income tax rise, as well as an increase in value-added tax (Walter & Carrick, 2007).

In 2002 Arbed merged with France´s Usinor and Spanish Acerlisa, and created Arcelor (with its headquarters in Luxemburg). The new firm employed a total of 104,000 employees and produced 5% of the world's steel. The Luxemburg government remained an active shareholder of the new firm. Arcelor was responsible for one third of the country's production and more that 12% of its energy consumption in the year of the merger. By the end of 2004, Arcelor's contribution to Luxemburg´s GDP had declined to 10%, and the total number of employees to 94,000 and in Luxemburg to 5,000 (Walter & Carrick, 2007).

In a CNN interview on May 30, 2005 (Benjamin, 2005), the CEO of Arcelor, Guy Dollé, stated his visions for the firm: (1) to become one of the leaders in the steel industry by producing 80 to 100 million tons (double what Arcelor was producing at the time of the interview), (2) to deliver continuous value to its shareholders, and (3) to grow to be one of the four major leaders in the industry for the future.

In January 2006, Arcelor outbid Germany´s ThyssenKrupp in a hostile takeover and acquired Canada's largest steel producer Dofasco for Cdn$5.6 billions. This increased Arcelor's presence in the North American market significantly (Walter & Carrick, 2007). The Mittal Steel initial hostile bid for Arcelor in January 27 was made just one day after Arcelor officially announced the takeover of Dofasco (Goralski, 2009).

MITTAL STEEL BECOMES THE NUMBER ONE STEEL PRODUCER IN THE WORLD

Mittal Steel was formed in 2004 by the India born industrialist Lakshmi N. Mittal. At that time, the Holland-based and publicly owned Ispat (of which the Mittal family held a 70% shareholding) purchased LNM Holding (which was wholly owned by the Mittal family) for US$13.3 billions and became the second largest steel producer in the world. The acquired LNM Group was formed in 1976, when Mittal purchased an Indonesian rod mill from his father and started acquiring steel assets all over the world (although primarily in developing countries, including Eastern Europe, see Figure 3). The LNM Group was one of the leaders in the consolidation of the global steel industry, with their clear strategy to emphasize size and scale (Walter & Carrick, 2007; Singh, 2008). The LNM Group specialized in producing flat and long steel products from

direct-reduced-iron, also called *sponge iron*. The direct-reduced-iron is produced by the direct reduction of iron ore using a reducing gas produced from natural gas or coal. This process is less capital intensive, uses less energy, and is overall less expensive than the conventional process (which requires sintering plants, coke ovens, blast furnaces, basic oxygen furnaces, and raw materials of stringent specifications). Also, conventional steel plants of less than one million tons annual capacity are generally considered to be economically unviable. This high breakeven point is probably the main reason that so many firms using the conventional iron production process had economic troubles during the cyclical downturns of the steel market and were shut down or sold (Ashrafian, Rashidian, Amiri, Urazgaliyeva, & Khatibi, 2011).

In 2005, Mittal Steel acquired the U.S.-based International Steel Group (ISG) and so became the first truly global number one steel producer in the world with operations in 16 countries (Reed, 2007; Walter & Carrick, 2007; Singh, 2008).

MITTAL'S TAKEOVER STRATEGY

In January 2006, Lakshmi Mittal was aware that Guy Dollé (the CEO of Arcelor) and his management team were completely focused on the hostile takeover bid of Dofasco, Canada's largest steel producer. He also knew that Arcelor's defenses against a hostile takeover were limited due to unusual movement in its share price during the months before the bid for Dofasco. Walter and Carrick (2007) described this situation:

The French Prime Minister's office and the Direction de Surveillance de Territoire (DST) had informed Arcelor's management that 20 percent of its shares had changed hands in November 2005, and the company was in a vulnerable position for a takeover bid.

Also, the Arcelor's shares were cheaper than Mittal's (at a P/E ratio of 4 against 5), and both companies were less valuable than comparable Japanese and U.S. steel firms, which had P/E's in the range of 7–9 (Walter & Carrick, 2007). These created the ideal situation for Mittal Steel to initiate a hostile takeover of Arcelor.

On January 13, 2006, Lakshmi Mittal invited Guy Dollé for dinner at his house in London and surprised him during pre-dinner drinks by proposing the merger between Arcelor and Mittal Steel. The outcome of this dinner was not clear, as Gumbel (2006) explained: Exactly what happened next is a matter of dispute. Dollé says he gave a noncommittal reply, and the two moved on to dinner and other business, leaving discussion about a possible merger open. "I said neither yes nor no," he recalled last week. "I just said 75% to 80% of mergers fail because of cultural differences." For his part, Mittal says Dollé immediately ruled out a deal. "He gave several reasons why he wasn't interested," he told Time. "I told him I'd get in touch again, and called a few days later to say there was an urgent need to meet." The men never did reestablish contact and on Jan. 26 —less than two weeks later—Mittal called Dollé on his mobile phone at Frankfurt airport while he was checking in for a flight to Toronto. The message: Rotterdam-based Mittal Steel would be announcing the following day a formal $22.6 billion takeover bid for Arcelor, one of the largest hostile bids in European history.

It is clear that Guy Dollé underestimated Lakshmi Mittal's determination to takeover Arcelor. Goralski (2009) further explained:

It is my opinion that Guy Dollé did not know enough about the culture of business in India to win this bidding war between Arcelor and Mittal Steel. As an Indian student, Lakshmi Mittal would have learned about logic, patience in business, and strategizing. Indian students are taught from rote with mathematical calculation. No decision is taken lightly. All decisions are calculated from all perspectives before a decision is made, regardless of the time necessary for the calculations to occur. Mittal knew Dollé, as both were board members of the steel industry's international trade group. They had discussed industry-wide issues. As a strategist, Mittal would have listened and taken the measure of Dollé during those conversations to use to his benefit in future negotiations. When Dollé mounted a personal attack on Lakshmi Mittal, claiming that he "did not want his shareholders to be paid with the Indian-born Mr. Mittal's 'monkey money'," Mittal would have recognized that Dollé was becoming emotional, which in India is viewed as a weakness. Mittal would have known that this assault was the beginning of the end.

MITTAL STEEL'S BIDS FOR ARCELOR

On January 27, 2006, Mittal Steel made its hostile takeover bid for Arcelor with an 18.6 billion euro cash-and-share offer for Arcelor. The offer proposed payment of a maximum of 4.7 billion euros in cash for Arcelor, with the rest financed through a stock offering of four new shares in Mittal Steel for every five held in Arcelor. The offer valued Arcelor's shares at 28.21 euros per share, a 27% premium on its close the night before the bid. The Mittal family shares in Mittal Steel would be reduced from 88% to 50.7%. Citigroup and Goldman Sachs were mandated to arrange a loan of 5 billion euros to support the cash portion of the bid (Marsh, 2006a; Walter & Carrick, 2007).

Two days later, on January 29, 2006, Arcelor's board rejected the offer. However, Arcelor's Chairman, Joseph Kinsch, stated in mid-February 2006 that the board of directors would reconsider the deal if Mittal Steel made an all-cash bid. This implied that the Arcelor board was considering the offer more closely, but that it was also aware that an all-cash offer would be a challenge for Mittal Steel, since it would have to raise almost all the funds through the loan market (Walter & Carrick, 2007).

On May 10, 2006, Mittal Steel raised its offer from 18.6 billion euros to 20.7 billion euros, but Guy Dollé still refused to meet Lakshmi Mittal. Despite Dollé's

position, Arcelor's Chairman, Joseph Kinsch, commented that he would be prepared to talk with Lakshmi Mittal as long as he provided (in advance) detailed information, including Mittal Steel's business plan and a financial forecast. Lakshmi Mittal refused this offer. Meanwhile, the U.S. and individual European states approved the parts of the deal in relation to antitrust. The only outstanding approval was from the European regulatory authority, although this was considered a mere formality (Walter & Carrick, 2007).

On May 17, 2006, Mittal Steel raised the offer again by 34% to 25.8 billion euros, with a 57% increase in the cash component. The new offer relinquished the Mittal family's control of the combined group, as the family's share would be reduced from 88% to just 43.5%. Despite the revised offer, Guy Dollé and Joseph Kinsch, were determined to avoid the Mittal Steel takeover (Walter & Carrick, 2007).

ARCELOR'S INEFFECTUAL DEFENSES AND SHAREHOLDER ACTIVISM

The Economist, on June 15, 2006, summarized the ineffectual defenses used by Arcelor against the hostile takeover by Mittal Steel and the disrespect of management for its shareholders:

"MONKEY money" is how Guy Dollé, chief executive of Arcelor, charmingly dismissed a hostile bid earlier this year from Indian-born Lakshmi Mittal, who runs (and largely owns) Mittal Steel. That was the high point of his defense of Europe's biggest steelmaker. Since then Mr. Dollé and Arcelor's chairman, Joseph Kinsch, have twisted and turned to escape Mr. Mittal. None of their scheming would count as more than two old men's efforts to cling to their jobs, except that shareholders everywhere also have a stake in this fight. For the sake of investors in Europe, what matters is not just who wins Arcelor, but how the battle is resolved.

The steel industry is consolidating. Mr. Mittal's €25.8 billion ($32.3 billion) bid would create a huge producer nearly four times the size of its nearest rival. The match, steel men judged, was a good one. Mittal could expand into Arcelor's high-margin markets, Arcelor could gain from Mittal's low-cost production. But Mr. Dollé would have none of it. The offer was "150% hostile," priced too low and strategically misguided. Through management and ownership, the untrustworthy Mittal family would dominate. Although Mittal Steel is registered in the Netherlands and run out of London, it did not in some mysterious way share Arcelor's European "cultural values."

Before long, that nasty little piece of Euro-nationalism was supplemented by opportunism and hypocrisy. First Messrs. Dollé and Kinsch bundled Dofasco, a recently acquired Canadian steelmaker, into a holding structure designed to frustrate Mittal's plans to sell it on—a poison pill, if ever there was one. Next they proposed to scotch Mittal by merging with Severstal, an opaque metals firm controlled by a Russian tycoon who, without launching a bid, was to become the dominant shareholder of the combined group. So much for Mr. Dollé's superior standards of corporate governance.

The victims in all this are Arcelor's own shareholders—something that should worry investors in Europe. All along, Messrs. Kirsch and Dollé have denied their own shareholders a proper shout. Investors had no say over Dofasco and they can stall the Severstal deal only if at least half of the shareholder register rejects the merger at a meeting in Luxembourg at the end of this month (see article). The threshold for such votes is usually a simple majority of those present: Arcelor's hurdle looks as if it was erected to be insurmountable.

The possible merger of Arcelor with Severstal (the largest Russian steel producer) enraged Arcelor's shareholders, as portrayed by the Economist on July 1, 2006: "This is the Chernobyl of corporate governance," says Bernard Oppetit at Centaurus, a hedge fund in London. Like many investors in Arcelor, the biggest European steelmaker, Mr. Oppetit is upset about the shabby treatment of shareholders by Arcelor bosses, as they attempt to fend off a hostile bid for their company by India's Mittal Steel. He and others are not prepared to continue to suffer in silence. They are rallying to force Arcelor bosses to give them more of a say in the decision over the company's future.

Taking advantage of the discontent felt by Arcelor's shareholders, Goldman Sachs (as Mittal Steel's advisor) launched an Arcelor shareholders campaign to force a vote on the merger with Severstal. More than one third of Arcelor's shareholders signed a letter demanding the right to vote on the proposed merger at a board meeting scheduled for June 30. The Arcelor board of directors summarily rejected this proposal, fearful that the deal would be turned down; under Luxemburg law, the deal could only be rejected if 50% of the shareholders attending a shareholders meeting voted against it. However, also under Luxembourg law, the board is obliged to meet with shareholders if more than 20% request a meeting. So, the board was forced to agree to an extraordinary board meeting to consider the voting rules on the Severstal deal for the shareholders meeting of June 30. On June 18, Arcelor announced the cancelation of the crucial June 30 shareholder's meeting, giving no clear reason (Walter & Carrick, 2007).

After additional shareholder protests and calls to destitute the board members and management, the Arcelor board finally ceded to shareholder's pressure and accepted the Mittal Steel offer of 26.9 billion euros. The deal was scheduled to be closed by the end of 2006 (Walter & Carrick, 2007). During this crucial phase of the takeover battle for Arcelor the European shareholders finally realized their true potential and established that they could impose their views on the management (Chabert, 2006).

MITTAL STEEL GOVERNANCE ISSUES

In The Economist on April 27, 2006, another article outlined what it considered the only valid argument used by Guy Dollé against the takeover: Mr. Dollé had one good argument to wield against the Mittal bid. The steel giant's corporate governance is not fair to minority shareholders. The Mittal family controls 88% of the firm's shares and each of their shares carries ten votes. Three members of the clan—Mr. Mittal, Aditya, his son who is also the company's chief financial officer, and Vanisha, his daughter—sit on the company's nine-member board. Mr. Mittal says he will rethink multiple voting-rights for shares—after the merger.

The Financial Times (Plender, 2006) also raised serious questions about the independence of Mittal Steel's outside directors. These questions about Mittal Steel's governance forced Lakshmi Mittal to make considerable governance concessions in the new firm (renamed Arcelor-Mittal) after the takeover of Arcelor by Mittal Steel (Financial Times, 2006). He had to give up the majority ownership of the firm that he founded (as the Mittal family had reduced its shares from 88% to 43.5%), he lost control over the board (he could appoint only six of the 18 board members), and he had to accept Joseph Kinsch (ex-Arcelor's Chairman) as the chairman of Arcelor-Mittal, and Roland Junck (ex-Arcelor) as its CEO. He remained as president and his son Aditya Mittal remained as the CFO (Schwartz, 2006).

POLITICIANS IN FRANCE AND LUXEMBURG WERE ALSO HOSTILE TO THE TAKEOVER

Negative comments against Mittal Steel's hostile takeover bid for Arcelor were by no means restricted to Arcelor's management. Key politicians in France and Luxemburg were also against the takeover. Jen-Claude Juncker, Luxembourg's prime minister, travelled to Paris for meetings with French president Jacques Chirac and the prime minister Dominique de Villepin. Afterwards, Juncker declared: "The hostile bid by Mittal Steel calls for reaction that is at least as hostile." He explained that the two countries had agreed on an approach, but gave no detail of the possible action they may undertake (Hollinger et al., 2006).

The hostility of Luxemburg's prime minister can be attributed to the historical importance of steel industry for Luxemburg, and the fact that in 1982 Luxemburg's government had saved Arbed (now Arcelor) from bankruptcy with the help of its taxpayers (and from that, the state still owned 5.6% of Arcelor shares). He was also concerned about the 5000 people who worked for Arcelor in Luxemburg (Walter & Carrick, 2007).

The French government was concerned for the 28,000 people who worked for Arcelor, but the French state did not hold any Arcelor shares, so its influence over the firm was limited. In addition, the state of Wallonia (the French speaking region of Belgium) owned 3.2% of Arcelor shares, and was equally concerned about the possible consequences of the takeover (Walter & Carrick, 2007).

After the initial reaction, politicians realized that they were powerless to prevent the hostile takeover bid of Mittal Steel (a Dutch firm) against Arcelor (a Luxemburg firm). Prior to this, Charlie McGreevy (the internal market commissioner of the European Union) had sent a letter to Thierry Breton (France's finance minister) demanding justification for provisions of new legislation that gave the government rights to impose conditions or veto takeovers, threatening legal action if not satisfied with the answer. This legislation was part of France's increasingly mood of protectionism that had become a sensitive issue in Europe (as outlined in The Economist, February 2, 2006).

At that time, the French government was finding it difficult to justify, on an intellectual level, its support for hostile takeovers by large French firms of foreign firms, while at the same time protecting local firms from being taken over by foreign ones (Betts, 2006). Besides, Arcelor shareholders (like Gérard Augustin-Normand, president of Richelieu Finances) were calling for politicians not to meddle and suggesting that fund managers needed to consider the offer only based on the merit of price (Hollinger et al., 2006).

INVESTMENT BANKS WERE SUPPORTIVE OF THE HOSTILE TAKEOVER

The investment banks that were active in Europe were supportive of the hostile takeover of Arcelor by Mittal Steel. They provided both advice, and financing and political lobbying. By the end of March 2006, Citigroup and Goldman Sachs (joined by Société Général, Commerzbank, Crédit Suisse, and HSBC) had secured 8 billion euros in loan commitments to back Mittal Steel's 18.6 billion Euros hostile offer for Arcelor. The investment banking advisory fees were estimated to be between US$90 and 100 millions (Walter & Carrick, 2007).

The French investment bank Société Générale in particular helped convince the French government to react kindly towards the hostile takeover. This came as a surprise, because Société Générale had a traditional relationship with Arcelor. Société Générale either concluded that the takeover was a better deal for Arcelor's investors or was simply motivated by the prospect of obtaining million dollars investment-banking fees (Goralski, 2009).

Convincing Société Générale to switch sides and support Mittal Steel was a brilliant tactical strategy by Lakshmi Mittal, according to Goralski (2009). However, this also demonstrated that modern investment banking relationships could swing from a potential target firm to a hostile takeover bidder if the fees were attractive enough, without constraints of loyalty or nationalism.

CONCLUSION

The hostile takeover of Arcelor by Mittal Steel reflects the changes in terms of governance, market for corporate control, and the mechanism for hostile takeovers, that had occurred in Europe throughout the last decade. These changes were mainly motivated by growing shareholder activism, led by institutional investors and hedge funds that entered the Continental European market during the 1980s and introduced this market to U.S. style shareholder activism. Lawmakers responded, and took various steps to reduce protectionism of local firms and increase shareholder's power vis-à-vis management and dominant shareholders.

Also, it became evident that mergers and acquisitions (particularly hostile deals) were consistently increasing target shareholders' gains. This created a market for corporate control, where firms that did not give the best return to their shareholders could replace their management with more competent management from another firm. This was the case of Arcelor's management (with a poor performance that reflected in P/E of 4), who was replaced by Mittal Steel's management (which had a better performance with a P/E of 5). The decisive factor for analysts and investors, in all likelihood, was that Mittal Steel´s management could better take advantage of the synergies of the combined firm and eventually reach the same P/E level of other steel firms (which were in the 8–9 P/E range). This was a huge windfall for Arcelor shareholders, who received a 43% price increase for their shares out of the deal (Financial Times, 2006).

The potential of the combined firms, the financial market boom, the availability of low cost financing, and the substantial fees, were probably the decisive factors that motivated the investment banks to promote the hostile takeover of Arcelor by Mittal Steel. Ironically, Mittal Steel's success was responsible for its later predicament.

The availability of cheap financing allowed Mittal Steel to grow and be successful in its takeover of Arcelor. However, the new firm, ArcelorMittal, was heavily indebted after years of deal-making and was vulnerable to the economic downturn started after the 2008 financial crisis. In an article in BusinessWeek, Reed and Biesheuvel (2011) explained the predicament of ArcelorMittal:

Three years of weak steel demand have put downward pressure on earnings and profits at ArcelorMittal, which is heavily indebted after years of dealmaking. The company also has to contend with a steel glut: Chinese mills have more than doubled production since 2005 to a projected 733 million metric tons this year, according to U.K. steel consultant MEPS. ArcelorMittal has trimmed back output some 20 percent from the 116 million metric tons it produced in 2007. Its share of the global market has fallen from 9.5 percent in 2006 to 6.4 percent in 2010, according to data compiled by Bloomberg.

The stock is down some 50 percent from its 52-week high in February. And Mittal's 40.9 percent stake in the company is now worth about $12 billion, down from $55 billion in 2008."

The problems of the euro and the need of global firms such as ArcelorMittal to adapt to new market realities by cutting European employment threaten to reverse the advances in the market for corporate control and the mechanism for hostile takeovers in Continental Europe. They may also motivate new protective and nationalistic policies from governments.

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UNDERSTANDING THE FINANCING DECISION OF BRAZILIAN PUBLICLY-TRADED FIRMS

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ABSTRACT

Among the theories that emerged from the Modigliani and Miller's contribution (1958) on the capital structure, there are those based on the balance between various benefits and costs of debt (Trade-off), as well as the Pecking Order Theory, whose creation is attributed to Myers and Majluf (1984). Shyam-Sunder and Myers (1999) showed that most empirical tests, that sometimes confirm or refute a certain theory, lack of statistical power, as a theory can be shown empirically correct even though firms have behaved accordingly to an alternative one. In this sense, theories may not be substitutes of each other, but play a complementary role. Later on, Almeida and Campello (2010) point out the fact that theories on capital structure neglected the role of financial constraints on the decision of managers, stating that the expected behavior of financially constrained firms may be substantially different from that of unconstrained ones. From a database of Brazilian publicly traded firms, observed between 2000 and 2013, we proposed an empirical test of Trade-off and Pecking Order theories considering the previous issues. First, we aimed to consider the main theoretical propositions on Dynamic Trade-off theory and, in addition, propose a new test for the Pecking Order Theory that considered the role played by financial constraints, as stated by Almeida and Campello (2010). Subsequently, we checked for the power of our regressions, using a procedure proposed by Shyam-Sunder and Myers (1999). The main results showed that a Dynamic Trade-off is confirmed in the sample, with relevant adjustment costs that allow firms to adjust only 7% quarterly towards a target debt ratio. The Pecking Order Theory with financial constraints was also confirmed, as firms that suffered no restriction assuming debt exactly in proportion 1-to-1 to their deficits, while firms under financial constraints not relating their indebtedness to their deficits – this deficit was prior corrected to consider the 'intended' investment, not the realized (constrained) one. Finally, once we applied the stress test proposed by Shyam-Sunder and Myers (1999), we found that both theories were confirmed, indicating their coexistence in the sample firms' day-to-day business. We concluded that unconstrained Brazilian firms use debt to finance their deficits, while the constrained ones use debt as a liquidity reserve. Additionally, when firms raise funds in a regular bank basis debt market in Brazil, they contract more as long as there is no alternative (as a hot market for public debt issuance or subsidized loans from BNDES) and the lower is the cost of funding and their degree of tangibility (less collaterals).

INTRODUCTION

In the field of Corporate Finance, many studies have been conducted regarding the capital structure of firms. Modigliani and Miller (1958) started a discussion about the relevance of the composition of capital for value creation, concluding that, given some assumptions, the capital structure did not influence the value of the firm. Since then, several other theories have been developed considering new perspectives, often by relaxing some assumptions dictated by Modigliani and Miller (1958).

Durand (1959), for example, points towards the existence of an optimal capital structures aimed to balance financial distress costs and taxes benefits. In 1963, Modigliani and Miller incorporated the taxes benefit in the 1958 original model, concluding that, since there is the possibility of deducting financial expenses from taxes obligations, the market value of the firms would increase with the use of debt. The debt assumed by the firms, however, is not free of costs, as assumed by Modigliani and Miller in their seminal works (1958; 1963). Among the most significant costs of debt would be those associated with financial distress and risk of bankruptcy. Although these costs do not happen very often, specially if the level of debt is not too high, they may be relevant for certain firms, operating in certain environments.

Models based on the trade-off hypothesis began to be tested in the 70s, giving rise to the so-called Static Trade-off theory (STO), which states that firms would pursue a level of debt able to balance benefits (such as taxes gains and the economy of equity agency costs) and costs (as bankruptcy and debt agency costs) (Jensen and Meckling, 1976).

Considering the existence of asymmetric information, Leland and Pyle (1977) argued that, by retaining a large equity stake of their firms, risk-averse entrepreneurs managing 'good' firms could signal the business's quality to investors since holding a large stake of the business comprises a costly underdiversification situation. However, this cost would be even bigger for bad business, as they face a greater downside risk. Complementing this idea, Williamson (1996) argued that the quality of corporate governance held by the firms would be a factor capable of influencing and being influenced by funding decisions to the extent that firms with better governance would enjoy more favorable conditions to attract external resources independently of the institutional environment in which they operated. So, good corporate governance would reduce the cost of financing under STO approach. On the other hand, it could be argued that the very structure of capital could act as a substitute mechanism of governance, as debt acts as a disciplining force, reducing the

agency cost of equity by limiting the discretion of managers. Thus, one must consider the quality of corporate governance of firms as a complementary mechanism to debt (able to reduce the cost of financing and to increase debt) or as a substitute one (reducing debt) (Perobelli *et alli*, 2005).

Subsequently, also in order to relax the assumption of symmetric information presented in Modigliani and Miller works, the Pecking Order Theory (POT) of Myers and Majluf (1984) emerged. According to this theory, the level of debt would not be a goal to be pursued by the firm, but simply the result of actions taken in order to reduce its budget deficit at the lowest possible informational cost. According to POT, firms should choose the level of debt trying to reduce the asymmetry of information among managers and financiers. Thus, retained earnings would be preferable to private debt, which would be chosen before the public debt, and issuance of stocks would be the last resource.

Recently, authors such as Almeida and Campello (2010) hypothesized complementarity between internal and external capital (as opposed to the substitute role defended by POT) under financial constraints situations. According to the authors, there would be an endogenous relationship between the level of intended investment and the level of external funding.

Since all those aspects are able to influence the decision regarding capital structure and, therefore, the value of the firm, the choice of capital structure is a very complex issue. In this article, we aimed to evaluate the theme for Brazilian publicly traded firms observed in the period 2000-2013 in order to answer the following questions:

1. Trade-off theory's hypothesized behavior is observed in the database firms? Under such theory, which are the variables related to the costs and benefits of debt? Specifically, which is the role played by corporate governance of firms?
2. Is it possible that the model of POT accommodate the role of financial constraints?
3. Considering the sample firms, which theoretical line (Trade-off or POT adjusted to consider financial constraints) explains the financing decision taken by Brazilian firms?

In order to answer those questions, a digression on some of the most important aspects of the literature regarding the choice of firms' capital structure, followed by a discussion of methodological aspects adopted in this work are presented. As main results, we found that both theories (Trade-off and POT adjusted to financial constraints) were confirmed, indicating their coexistence in the sample firms' day-to-day business. We concluded that unconstrained firms in Brazil use debt to finance their deficits, while the constrained ones use debt as a liquidity reserve. Additionally, when firms raise funds in a regular bank basis debt market in Brazil, they contract more as long as there is no alternative (as a hot market for public debt issuance or subsidized loans from BNDES) and the lower is the cost of funding and their degree of tangibility (less collaterals).

INTRODUCTION

Considering the direct influence that funding would have on the creation (or destruction) of value, authors such as Durand (1952; 1959) argued that there was an optimal combination of debt and equity able to minimize the firm's financing costs, maximizing its value. However, for Modigliani and Miller (1958), this relationship would not exist in the absence of market imperfections. Later, those authors have eased the premise of no taxes on corporations and concluded that, with deductibility of interest paid by firms from their taxes obligations, the market value of a firm would grow as it obtained more debt (Modigliani and Miller, 1963).

The propositions of Modigliani and Miller with and without taxes (1958 and 1963) are strongly based on a risk-free debt assumption. Copeland and Weston (1988) argued that, for low levels of debt, the risk of bankruptcy is low and therefore the cost of debt can be assumed to be risk free. However, as the leverage rises, the risk of bankruptcy and the cost of debt also rise, which makes room for a mechanism of trade-off between taxes benefits and costs of bankruptcy coming from leverage.

The costs of debt, however, does not come solely from the increased likelihood of bankruptcy, as well as its benefits are not restricted to the taxes deduction. Thus, other works and theoretical arguments were developed in order to map all kinds of costs and benefits associated to the debt ratio that might make it possible to calculate a level of optimal leverage. Jensen and Meckling (1976), for example, introduced a theory based on agency costs associated with the issuance of equity and agency costs associated with the issuance of debt, such as there would be an optimal combination of equity and debt able to minimize overall agency costs. In the case of equity agency costs, a former shareholder (and also manager) would be encouraged to pursue private benefits of control, as he/she would be paying just part of the total cost of those (the rest of the costs would be paid by the new shareholders). Besides, the lack of strong stakeholders able to monitor efficiently the behavior of the major shareholder/manager would stimulate him/her to invest in projects of personal interest (pet projects), some with negative NPV, generating the overinvestment problem. In the case of debt agency costs, the most common ones regard to monitor managers, which generates 'bonding costs'. The establishment of covenants able to protect creditors from expropriation of managers could lead to a reduction in the firm's profitability and hence in its value, generating the underinvestment problem. Therefore, from the perspective of Agency Theory, high debt level implies underinvestment, while low debt level implies overinvestment. Both cases destroy value. So, there would be an optimal level of debt able to minimize the overall agency costs of equity and debt.

According to Shyam-Sunder and Myers (1999), the optimum level of debt, however, would not be the same for all firms. Considering the characteristics of the firms, the optimal debt level would be relatively high for safe and stable firms (few growth opportunities), whose profits were large enough to get high taxes benefits (debt taxes-shields) and for those firms whose assets would not suffer great loss of value in a bankruptcy event (tangible assets). For these authors, trade-off theories generate some immediate empirical hypotheses, as a cross-sectional correlation between the level of debt and operational risk and growth (negative), profitability (positive), debt taxes shields and non-debt taxes-shields[1] (positive and negative, respectively), tangibility (positive) and uniqueness of the assets (negative). In addition, it predicts a reversal of the current debt level to an optimal debt ratio to be pursued by firms able to balance the benefits and costs of debt. Empirically, Shyam-Sunders and Myers (1999) cited the works of Miller and Modigliani (1966), Schwartz and Aronson (1967), Taggart (1977), Marsh (1982), Jalilvand and Harris (1984), Auerbach (1985), Long and Malitz (1985), Mackie-Mason (1990), Smith and Watts (1992), Opler and Titman (1994) as the first ones to find results in favor of a Trade-off theory, sometimes testing the relationship between debt level and benefits and costs of debt, sometimes checking for the reversion of debt levels to an optimum level.

On the other hand, an important work of Titman and Wessels (1988), using latent variables related to the theoretical constructs of Trade-off theory, reached results that were not fully explained by that theory. Before that, Myers (1984) had already hypothesized that the negative relationship observed in stock prices due to the issuance of stocks or debt reduction, observed in the work of Masulis (1980), found no support under Trade-off theory. For that author, if firms change the level of debt (up or down) in search of an optimal point, any movement should be positively received by the market, given its favorable content. Kester (1986) and Rajan and Zingales (1995) papers also found evidence of past negative relationship between profitability and debt, the opposite of the relationship advocated by the Trade-off theory. As a result, alternative theories were considered, the most important being the Pecking Order Theory (POT), formulated initially by Myers (1984) and Myers and Majluf (1984).

According to POT, the existence of information asymmetry and problems arising from signaling private information to the market justify the first choice of managers by internally generated funds, then private debt, public debt and, as a last resort, stock issuance. A strict interpretation of this theory, found in Shyam-Sunder and Myers (1999), suggests that firms would have no optimal debt target, but that debt ratio would result from choice under the POT hierarchy of financial instruments over time. Under POT, firms facing financial deficit due to intended investments would resort to debt (external funds), the opposite correlation held by the Trade-off theory and similar to that empirically obtained by Titman and Wessels (1998) and Rajan and Zingales (1995). Consequently, firms could also become resource lenders in the market if they could obtain successive surpluses. Obviously, such resources could also be directed to stocks repurchases.

For POT, taxes benefits, bankruptcy costs and agency costs are second order issues. According to this theory, the level of debt would change when there was a mismatch between the cash flow generated internally and debt repayments, dividends and the intended investment in working capital and capital expenditures. Thus, profitable firms with few investment opportunities would present lower levels of debt; by the same coin, firms whose investment opportunities would exceed the internally generated funds would use more debt (positive relationship between growth and debt and negative between profitability and debt).

Interestingly, while the pace of cash generation and profitability should be positively related to the level of debt under the Trade-off theory (stable firms with high debt taxes shields), according to POT this correlation should be negative (firms able to generatie funds internally should rely less on debt). The same dichotomy is checked for the potential growth of the firm, leading to higher levels of debt according to POT (positive relationship) and lower levels of debt according to the trade-off theory (negative relationship).

Another important milestone in this literature was the incorporation of debt adjustment costs (Fisher *et alli*, 1989) in the financing decision. According to this argument, allocating leverage level to an optimal is an expensive procedure, so firms would only undertake it when losses from deviation exceeded the costs of the adjustment. Thus, a firm should leave debt vary by exogenous issues and the adjustment would not be instantaneous. This theory, in which there is not a level but an optimal trajectory path for debt, is known as Dynamic Trade-off (DTO).

From those seminal works, some other discussions came up. We can quote, for example, those that consider the level of corporate governance, which can act both in a substitutive or complementary way to debt. Black (2000) argued that, in markets with low protection to minority investors and little transparency, investors would apply a general discount on the value of the stocks offered by firms to ensure they would be paying for them a fair value. Therefore, in such markets, there would be no other way for firms with good governance practices but to seek other sources of funding, including debt, leading to a positive relationship between corporate governance quality and degree of debt, *ceteris paribus*. A distinct line of argument leads to a similar prediction. According to Silveira (2004), even within an institutional environment with little protection, some firms could be distinguished as "with good governance", making them more attractive to outside investors, *ceteris paribus*, and thus increasing the amount of individuals interested in allocating resources on them, either as equity or debt. Both lines of argument predict a positive correlation between quality of governance and access to external capital. On the other hand, a significant financial leverage imposes on managers

[1] *Non-debt taxes-shields* may be, for example, "taxes benefits" from the amortization of intangible and the depreciation of tangible assets.

the so-called "debt discipline", which follows both from specific contractual restrictions set by creditors to firms (covenants) and from firm's commitment to distribute profits as interests, reducing managerial discretion when using investors' resources (Jensen, 1986; Williamson, 1996). So, the choice of debt in capital structure could work as a governance substitute mechanism in some firms, reducing the need of implementing additional (and potentially costly) corporate governance mechanisms (Perobelli, Silveira and Barros, 2005).

Berger and Udell (1998) produced the life cycle theory. According to it, the firm undergoes a process of birth, growth, maturity and death. The phase of growth is associated with underinvestment (lack of resources) and the phase of maturity with overinvestment (excess resources), complementing the results of agency costs theory. In this context, the debt would have a positive role of preventing the firm from overinvesting (which is more likely to occur in the low potential growth phase of maturity) and a negative one when limiting a firm that is already in underinvestment situation (which should occur in the high potential growth phases of birth and growth). Some studies have linked this theory to that of "creative destruction" (Mueller, 1972), postulated by Schumpeter (1934).

Further complementing the arguments based on Trade-off theory, there are those of management inertia and market timing. Under management inertia, Welch (2004) stated that proxies traditionally used in empirical studies of Trade-off theory fail to explain most of the dynamics of the capital structure when considering the value of stocks in the market. For Welch, all other variables only have a secondary role in capital structure since the debt/equity ratio would be correlated with the stock prices. Therefore, the dynamics of the market value of the firm also 'determine' the capital structure. Based on a sample of approximately 2,500 firms between the years 1962 and 2000, the author concluded that the returns per stock were considerably more important for the debt-equity ratio than proxies usually used in studies related to Trade-off theory. The hypothesis of managerial inertia argues that managers simply do not deliberately influence the firm's capital structure. The choice or search for a certain debt level or ratio (static or dynamic) is not part of the managers' decision, who just let the firm's value change according to market variations.

Turning to the market timing argument, in the definition provided by Baker and Wurgler (2002), it is observed that the existence of windows of opportunity in the stock market influences managers' financial decision. According to the authors, the capital structure of a particular firm would simply be the result of cumulative decisions taken during windows of opportunity. In fact, there must be disparities between the fundamental value and the market value of the firm, so one would assume that, at certain times, the decision of issuing stocks (if they are overvalued) and repurchasing them (when they are undervalued) should not be ignored. According to this strategy, managers would be able to decrease the cost of financing operating windows of opportunity and making the firm more valuable.

The point raised by Baker and Wurgler (2002) is to identify if the use of windows of opportunity has short or long-term effects on the level of firms' leverage. If firms constantly rebalanced their capital structure, it would be observed only short-term effects. The market timing in capital structure became, therefore, an empirical problem. Graham and Harvey (2001) conducted a field survey, by interviewing CFOs of several different firms, in which two thirds stated categorically that both under/overprice and the size of market price error were important issues to be analyzed in the decision of issuing equity. Besides, after stock issuance, the stock return usually decreases (or increases when firms repurchase), suggesting that the market was really over or underestimating those firms' stock prices. Finally, it is clear that issuance of stocks by firms usually occur when the market appears to be highly enthusiastic about the earnings prospects of them. Those facts are mentioned by Baker and Wurgler (2002) as possible empirical indicators that market timing is important in the financing decision.

The final question, then, was to verify whether those effects were long lasting. Using a sample of about 3,000 US firms between 1968 and 1999, the authors conducted an empirical research, testing for long-term effects. The market-to-book ratio was used as a measure of windows of opportunity and showed that overleveraged firms were those that searched external funds when their market value were low (so it would be better to issue debt) while less leveraged firms were those that used equity when their market values were in the highest levels. They also showed that fluctuations in the market value of the firms generated large effects on their capital structure, which last for at least a decade.

Although Trade-off and POT are usually placed as competitor theories, it could be argued that both theories should be able to coexist. Regarding the Trade-off, an important issue for the firm is to achieve the optimal debt-equity ratio. Assuming that windows of opportunity exist in the economy, and are exogenous to the financing decision, they clearly represent opportunities to reduce the costs of fundraising and thus to add value to the firm. The value increase does not occur by investing in profitable projects, but by reducing the cost of capital in the market. If that increase in value exceeds the costs of the issuance, the firm maximizing its value must practice it, according to the postulated by Trade-off theory.

About Pecking Order Theory, when the purpose of the issuance turns to investment (determined exogenously), stocks would always be the last option in terms of funding. On the other hand, in order to increase firm value by speculating in the market, the stocks could be a viable alternative in the market timing theory. Although Baker and Wurgler (2002) have pointed out categorically that the two theories should disagree, they would not necessarily conflict. Sometimes firms could issue stocks in order to arbitrage the price overestimated by the market (or to repurchase stocks as a result of underestimation).The market timing theory,

therefore, would be important to help those theories based on Trade-off or POT, without necessarily conflicting with them. Thus, it is important to use a variable, or proxy, able to isolate the effects expected for it in models based on Trade-off and POT.

For Shyam-Sunder and Myers (1999), arguments based on Trade-off generate immediate empirical implications. Consider the dynamic version of Trade-off (DTO). The functional form proposed by Shyam-Sunder and Myers (1999) for its estimate is:

$$\Delta D_{i,t} = \alpha + \beta_{DTO}\left(D^{*}_{i,t} - D_{i,t-1}\right) + \mu_{i,t} \quad (1)$$

where $D^{*}_{i,t}$ is the debt target to be pursued by the firm i. Given the difficulty of observing this goal, it is usually used as proxies of it the industry leverage average or the firm historical leverage average. However, as proposed by Flannery and Rangan (2006), the target debt may be represented by a function of firms' characteristics (*X*). It can be established as: $[D^{*}_{i,t} = \gamma(X_{i,t})]$. Replacing the target vector function *X* in (1) and rearranging the terms, the functional form to test arguments based on Trade-off becomes:

$$D_{i,t+1} = \beta_{DTO}.\lambda.X_{i,t} + (1 - \beta_{DTO}).D_{i,t} + \mu_{i,t+1} \quad (2)$$

The DTO is verified if coefficients $[\beta_{DTO}.\lambda]$ are significant, indicating that the characteristics considered in *X* directly influence the next period debt decision. Furthermore, to confirm the validity of the dynamic theory, it is expected that the coefficient of the lagged debt variable is less than 1: $[1 - \beta_{DTO}] < 1$. Values greater than 0 and less than 1 indicate the presence of adjustment costs, meaning that the debt is not immediately relocated to the optimal point related to firms' characteristics. If it's exactly 1, there is no target (firms do not pursue any particular debt), but if the value of the coefficient is exactly 0 (or not significant), the result indicates the absence of adjustment costs, so at each period the debt is fully relocated to the optimum level chosen in accordance to the relevant firms' characteristics. In order to consider Welch's theory (2004) and avoid interference of market value fluctuations of the stock prices in the model, it is suggested to use the accounting level of debt and equity in the estimation.

Shyam-Sunder and Myers (1999) also proposed the estimation of a model for empirical validation of POT. The equation proposed by the authors is:

$$\Delta D_{i,t} = \alpha + \beta_{POT}.DEF_{i,t} + \mu_{i,t} \quad (3)$$

where $\Delta D_{i,t}$ would be the amount of debt issued (or removed if $DEF_{i,t}$ is negative) for firm *i* at time *t*. Thus, to ensure resources that complement the firm's needs, this firm would turn to the capital market, taking on new debt.

Alternatively, if the cash flow generated surplus related to the firm's needs, the firm should opt for stock repurchases or debt amortization. The POT would be verified if the coefficients $\alpha = 0$ and $\beta_{POT} = 1$ were found empirically.

The paper of Almeida and Campello (2010) was the first one to consider the presence of financial constraints as an important factor to be considered under the basic model of POT, concluding that firms that face difficulties in fundraising would behave differently from those that were able to easily borrow risk-free capital. According to the POT, in an information asymmetry scenario, if a firm achieves high profits, its reaction would be to decrease external funds, including debt; so, a negative relationship between internal and external funds would occur.

However, according to Almeida and Campello (2010), there are three different effects that might explain the neutral (or even positive) relation between external and internal funds in an endogenous investment decision context. First, a financially constrained firm deals with a crucial decision: use the internally generated funds to reduce the demand for external resources or to increase current capital expenditures. This trade-off occurs because investments in firms suffering financial constraints are, by definition, lower than the intended level. A firm with this kind of limitation could use internal resources to increase capital spending instead of reducing the use of external funding, given the high opportunity cost of losing investments.

Second, a firm that is financially constrained would not be only concerned about financing of current projects, but also with future investment opportunities. The need to finance future projects under credit crunch increases the firm demand (preventively) for both liquid assets (cash), as well as for external capital.

Finally, the high external financing costs for financially constrained firms create a direct complementarity between generating internal cash and the capability of getting external resources. A financially constrained firm can use part of internal resources to purchase assets that could be used as collaterals, those being able to increase the size of the firm and its ability to obtain additional resources. These new external resources will be re-directed to new assets, increasing the positive effect of these assets in obtaining external resources (credit multiplier).

All these effects point out to the same conclusion: while increasing its cash flow, a financially constrained firm should not reduce but increase its preference for external resources. The constrained firm, controlling for other factors, has better allocation to additional resources (more investments or tangible assets that could be used as collateral) and could find more important to increase its demand for external resources precisely at times when the generation of internal funds is higher.

With this complex framework in mind, a list of firms' characteristics was chosen in order to test DTO and POT adjusted versions for Brazilian publicly traded firms.

METHODOLOGY

This article methodology consists in a procedure similar to that addressed in Shyam-Sunder and Myers (1999). As argued by the authors, using a time series approach and simulation to verify the power of statistical tests of null hypothesis related to DTO and POT, our goal is to answer the questions formulated in Introduction. So, a model for DTO was adapted for considering as much as possible theoretical costs and benefits of debt. The model for POT was also adapted to incorporate the recent discussion on the role of financial constraints (Almeida and Campello, 2010).

The goal for Trade-off model itself is particularly very ambitious. A wide database was tested, which should be able of simultaneously considering most cost and benefits of debt discussed in topic 2. This means that the functional form proposed here should be able to incorporate the taxes benefit (Modigliani and Miller, 1958), the probability of bankruptcy and agency costs (Jensen and Meckling, 1976), adjustment costs (Fisher *et alli*, 1989; Shyam-Sunder and Myers, 1999; Flannery and Rangan, 2006), the possibility of inertial management (Welch, 2004), the importance of the growth opportunities associated with the life cycle of the firm (Mueller, 1972; Berger and Udell, 1998; Fluck *et alli*, 1998), the corporate governance role (Williansom, 1996) and the existence of exogenous windows of opportunity for market timing (Baker and Wurgler, 2002).

Table 1 shows which proxies were used for each of those characteristics in the Trade-off equation and the expected signal for each characteristic that has been widely studied over the years. To adapt the POT model, the challenge was to create a functional form able to incorporate the role of financial constraints. It was necessary to make it possible for firms under financial constraints to be evaluated differently from those that had no such restriction.

Once functional forms were defined, empirical tests were done separately to determine whether the sample of Brazilian publicly traded firms behaved as each of the theories on choosing capital structure. Subsequently, using the estimated regressions results, it was possible to carry on a data simulation and thus replicate each test using simulated data (instead of observed ones) in order to check the power of each regression, as proposed by Shyam-Sunder and Myers (1999).

Although the goal in the first test was to evaluate the target debt assumption recommended by the Trade-off theory arguments, it is important to emphasize that also for POT certain theoretical relations between the firm characteristics and the debt level should be expected. There are cases where the theories based on Trade-off and POT agree and some other cases where the signal expected for each theory would be reversed. Regarding profitability and growth, for instances, theories would disagree. A positive sign for profitability and a negative one for growth would verify DTO, while a negative sign for profitability and a positive one for growth would favor POT. Under the adjusted version of POT, however, both would agree according to those characteristics when dealing with financially constrained firms. Considering growth opportunities, constrained firms should maintain relatively low debt, in order to not undermine their future credit capacity. By the same token, when facing high profitability, those firms should invest more in tangible, collateralized assets, in order to create a credit multiplier, instead of repaying debt. So, under financial constraints, it is possible that DTO and POT coexist.

SEE TABLE 1 ON NEXT PAGE

In order to test POT as proposed by Shyam-Sunder and Myers (1999):

C_t = Operations Cash Flows, after Interest and Taxes
DIV_t = Dividend Payments
X_t = Capital Expenditures
ΔW_t = Net Variation in Working Capital
R_t = Current Portion of Debt paid during period t

$$DEF_{i,t} = DIV_{i,t} + X_{i,t} + \Delta W_{i,t} + (R_{i,t} - C_{i,t}) \qquad (4)$$

In the formula presented above, all components should be exogenous since any amount of debt could be issued. The functional form for the POT test would then be the following:

$$\Delta D_{i,t} = \alpha + \beta_{POT}.DEF_{i,t} + \mu_{i,t} \qquad (5)$$

where $\Delta D_{i,t}$ would be the amount of debt issued (or removed if $DEF_{i,t}$ is negative). The POT would be verified if the coefficients $\alpha = 0$ and $\beta_{POT} = 1$ were found empirically.

However, in order to accommodate the financial constraints possibility, the functional form of the POT to be tested should be adjusted. Shyam-Sunder and Myers (1999) considered the level of investment observed as equal to the intended investment (exogenous variable). Although correct under no financial constraints, this approach cannot be used in the context of financial constraints and endogeneity between intended investment and required financing.

Table 1: Variables Description and Expected Signs

	EXPECTED SIGN					
	TRADE-OFF		POT			
VARIABLE	SIGN	REFERENCE	SIGN	REFERENCE	REGRESSOR	VARIABLE DESCRIPTION
Profitability	(+)	Harris and Raviv (1991)	(-)	Rajan and Zingales (1995)	$ROAOP_{it}$	Operating Income / TA
					ROA_{it}	Net Earnings / TA
			(+)	Almeida and Campello (2010) - Adjusted	$MARG_{it}$	Margin (Net Earnings / Sales)
					$TURN_{it}$	Turn (Sales / TA)
Firm Size	(+)	Harris and Raviv (1991); Rajan and Zingales (1995)	(+)	Ross (1977); Harris and Raviv (1991); Rajan and Zingales (1995)	$LNREV_{it}$	LN(Revenues)
					$LNTA_{it}$	LN(Total Assets)
					LNE_{it}	LN(Equity)
Growth Oportunities	(-)	Jensen and Meckling (1976)	(+)	Frank and Goyal (2003)	MTB_{it}	Market-to-book.
			(-)	Fama and French (2002) – Adjusted	$VARREV_{it}$	Revenues Percentage Variation
					$VARTA_{it}$	Total Assets Percentage Variation
Free Cash Flow	(+)	Jensen (1986)	(-)	Myers and Majluf (1984)	$MGEBITDA_{it}$	EBITDA Margin
			(+)	Almeida and Campello (2010) – Adjusted	$MGOP_{it}$	Operating Income Margin
Tangibility	(+)	Harris and Raviv (1991); Shyam-Sunder and Myers (1999)	(-)	Harris and Raviv (1991); Frank and Goyal (2003)	$TANG_{it}$	Fixed Assets / Total Assets
			(+)	Almeida and Campello (2010) – Adjusted		
Taxes Shields	(+)	Harris e Raviv (1991), Shyam-Sunder and Myers (1999), etc	(*)		$FISC_{it}$	Earnings Before Taxes / Sales
Non-debt Taxes Shields	(-)	Harris and Raviv (1991)	(*)		$NTAX_{it}$	Depreciation / Total Assets
Operational Risk	(-)	Shyam-Sunder and Myers (1999)	(*)		$SDEBITA_{it}$	EBITDA's Standard Deviation
					$SDOP_{it}$	Operating Income's Standard Deviation
Singularity	(-)	Harris and Raviv (1991); Shyam-Sunder and Myers (1999)	(*)		$SALES\_REV_{it}$	Sales / Revenues
Liquidity	(+)	Harris and Raviv (1991)	(*)		$LIQA_{it}$	Current Assets / Current Liabilities
	(*)		(*)		$DISP_{it}$	Disponibilities (Cash, Financial Investments) / Total Asset
Liquidity in Stock Market	(*)		(*)		$LIQB_{it}$	Liquidity in Stock Market according to Bovespa
					$VOLNEG_{it}$	Market's volume of Trades
Maturity	(+)			Fluck, Holtz-Eakin and Rosen (1998)	AGE_{it}	Firm's Age
	(-)			Fluck, Holtz-Eakin and Rosen (1998)	$AGE2_{it}$	Squared Firm's Age
	(*)		(*)		$IPOAGE_{it}$	Firm's Age since its IPO
					V_VS_{it}	Sales / Sector Sales
Dividend Distribution	(*)		(*)		$DISTRIB_{it}$	(Dividends + Interests over Equity) / Net Equity
					$VARE\_REV_{it}$	Equity's Variation / Sales
Corporate Governance	There are 2 possibilities here: Corporate Governance could have a complementary effect, as it leads to better conditions in credit access. On the other hand, Corporate Governance could act as a substitute of debt as it lowers manager's power and discretion. A positive sign (+) is expected if CG is complementary to debt and a negative sign (-) if CG has a substitutive role.				SEG_NM_{it}	Dummy: 1 if firm belongs to "New Market" segment according to BMF-Bovespa
					SEG_N1_{it}	Dummy: 1 if firm belongs to "Corporate Governance level 1 segment" according to BMF-Bovespa
					SEG_N2_{it}	Dummy: 1 if firm belongs to "Corporate Governance level 2 segment" according to BMF-Bovespa
					$CONC1_{it}$	Firm's percentage of holders marked as Controling Group according to CVM
					$CONC2_{it}$	Sum of all stocks that belong to holders with at least 5% of the firm
Windows of Opportunity	(*)		(*)		$RISKFREE_t$	Selic – Brazilian Basic Interest Rate
					$RETIBOV_t$	Bovespa Index (IBOVESPA) Return – per year
					$RETSTOCK_{it}$	Stock Return – per year
					$VARBONDS_t$	Percentage variation of Short Term debentures issuance – per year
					$EXPOL_t$	Dummy: 1 if expansionary policy is adopted by government
					$QUALD_{it}$	Debt Quality Dummy: 1 if (EBITDA / TA) > KD
					KD_{it}	Debt Cost: $(\text{Financial Expenses})_t$ / $(\text{Total Debt})_{t-1}$
Ibovespa[2]	(*)		(*)		$IBOV_{it}$	Dummy: 1 if firm belongs to hypothetical portfolio of Bovespa Index (IBOVESPA).
BNDES	(*)		(*)		DUM_BNDES_{it}	Dummy: 1 if firm has received any BNDES resources in period t.

Source: Prepared by the authors

[2]Bovespa Index in September/2013.

Considering that firms under financial constraints have different behavior from those that do not suffer from such restriction, it is proposed to include a dummy that makes possible different β coefficients for the constrained and unconstrained firms. Thus the adapted equation becomes:

$$\Delta D_{i,t} = \alpha + [\beta_{POT} + (\gamma_{POT}.Dum_{i,t}^{rest})].DEF_{i,t} + \mu_{i,t} \qquad (6)$$

where dummy is 1 for the *i* financially constrained firm at time t and 0 for the unconstrained ones. Thus, β_{POT} coefficient is for all firms (with and without financial constraints) and the coefficient γ_{POT} exclusively considers firms under financial constraints.

Additionally, the coefficients for the group of firms can be defined as following: $[\beta_{unconst} = \beta_{POT}]$ is the coefficient of unconstrained firms and $[\beta_{const} = (\beta_{POT} + \gamma_{POT})]$ is the coefficient of financially constrained ones.

It's expected that firms that do not suffer from financial constraints are able to acquire all funds necessary to make their intended investments in credit markets. The other firms, however, would be able to borrow only a portion of their capital needs, which means they only realize part of the intended investment.

Thus, the test would corroborate with the POT if $\beta_{unconst}$ = 1, i.e. firms without financial constraints would continue acting exactly as recommended by the original version of POT, and the expected value for β_{rest} would have two possible solutions: the first case being 0 < β_{const} < 1, i.e. under financial constraints, firms would take loans to the extent that was possible, performing only a portion (the highest possible) of investment. This hypothesis is in accordance with the Frank and Goyal (2002) simple version of POT; and the second possibility being β_{const} =0. Statistically, this information means that the variation of the firm's debt in a certain period has no correlation with its deficit. In other words, the decision on debt is not determined by actual financial deficit, being more related to the constraint itself. Frank and Goyal (2002) indicated that, in this complex version of the POT, a firm's decision also takes into account the future horizon.

For firms under financial constraints, this component becomes even more critical. In this case, the concern about the constraint itself may be more important to the firm than the immediate investment in projects that require extra capital. As pointed out by Almeida and Campello (2010), the investment decision in financially constrained firms profoundly changes the behavior of managers, who may prefer to solve the problem of restriction (purchasing assets to use as collaterals and searching the multiplier effect of credit) or forward planning (not "spending" all the credit, saving for the possibility of future investment).

After determining the functional form adapted for considering the role of financial constraints, two extra issues required attention in the POT estimation. The first one has to do with a criteria to define which firms should be considered the financially constrained ones. We chose to use the cluster method that makes it possible to simultaneously consider several firms' characteristics in order to distinguish the financially constrained ones from the rest.

Second, since the intended investment by firms under constraints cannot be observed, it was necessary to define a proxy for this variable. As for firms that suffer no restriction the intended investment is exactly the observed investment, we decided to pair firms, where each constrained firm has to be considered similar to another unconstrained one. Thus, the investment made by the second firm was used as the intended investment for the first one. Therefore, a propensity score matching procedure was used to pair each financially constrained firm to an unconstrained one.

CONSTRAINED FIRMS – CLUSTER ANALYSIS METHOD

Based on Almeida and Campello (2010), size and dividends were used as determinants of financial constraints. Regarding the size, following the approach of the authors, larger firms were considered less likely to suffer restriction. The same can be said of those whose dividend distribution is higher. For these firms, they are choosing to pay to shareholders rather than reinvesting or retaining the capital in cash to ensure the realization of future investments. So, it was also assumed that they are less likely to suffer restriction.

Almeida and Campello (2010) also used two other criteria to distinguish financially constrained firms based on the rating of firms' bonds and commercial paper. Surely, firms whose public debt security is highly-rated would hardly have difficulties in raising external capital to make investments. The Brazilian case, however, is much more rudimental in this aspect, thus this information is scarcer. Trying to replace this parameter, the dummy for participation in the Bovespa Index was used. The reason is that if the market is hot for certain firms' stocks – criteria for participation in the index – it's likely that an issue of debt security (or request for private funding) won't find trouble in being successful. Thus, these firms should have a low probability of incurring in financial constraints.

The method of cluster analysis was undertaken to separate different groups of individuals based on size, dividends payout and Bovespa Index participation. An important caveat that must be seen in the cluster analysis method is that, unlike most of the statistical methods employed, the range of variables influences the result. Size and distribution are continuous variables and must follow "soft" distributions, with no great disparity between an observation to another, i.e. if firms are sorted from smallest to largest or from lesser to greater dividends, we expect a wide variability and no big leap between the value of an observation and the next. Thus, the cluster approach is suitable for this sample. The standardization

of these variables is justified by the issue of equal weighting of both characteristics. After standardization these variables, they have zero mean and standard deviation of one.

The Bovespa Index participation variable, however, is a dummy that assumes values 0 and 1. The Bovespa Index (or any dummy) can be thought to detach two horizontal and parallel planes in a cluster analysis. No individual is between the parallel planes, creating a gap between them. So, something must be done about it. In practical terms, it is expected that clusters split large firms and those with higher distributions of dividends from smaller ones which distribute less, while it also takes into account the participation (or not) in the Bovespa Index. In a first step, firms that are "very" big or that distribute "a lot" should be allocated in the group that are not under financial constraints, regardless of the observed value of the dummy. "Very" small firms and those with "low" amount of dividends distributed should be considered financially constrained, even if they participate in the Bovespa Index. Thus, we decided that the dummy would have a very specific goal, that is, to make only those firms whose size and distribution are just a little distant from the cluster boundaries to change groups. For example, a big firm (but "not so big") and whose dividend distribution is high (but "not so high") could be allocated in the group of firms that do not suffer from financial constraints if and only if it participates in the Bovespa Index; otherwise, it would be reallocated to the group of financially constrained ones.

To make sure that the dummy is responsible only for changing a few firms placed next to the clusters boundaries, the procedure adopted consisted of a first step, which formed groups without using Bovespa Index participation. In the second step, it was used the standardized standard deviation of 1 to Bovespa Index participation. If there was an excessive amount of firms migrating from one group to another, the second step was redone, with the standard deviation of the dummy reduced until the result got closer to the expected, the migration of only a minor amount of firms.

Finally, it is important to note that, in order to mitigate the temporal effects, clusters were set annually. Thus, structural changes that simultaneously affected all firms over a given period were not taken into account.

By this way, a new dummy variable for 'constraint' was used in this paper, which takes value 0 for firms that were allocated in the cluster of large firms with greater dividends distribution and participating in Bovespa Index (less likely to be financially constrained) and value 1 if opposite (forming the group of firms likely to suffer financial constraints). Once groups were separated and the restriction dummy created, the next step was to generate the intended investment proxy for firms under financial constraints, in order to calculate the deficit to be used in equation (3).

THE INTENDED INVESTMENT OF CONSTRAINED FIRMS - PROPENSITY SCORE MATCHING

As explained, it is not possible to observe the intended investment of firms under financial constraints. Unlike those firms that do not face the problem, the investment of constrained firms is always fallen short. The challenge, therefore, is to find a proxy able to replace the (endogenous) variable of investments. Whereas 'similar' firms should have an intended 'similar' investment, the proposal is to find an unconstrained firm similar to a constrained one by a matching procedure, that is, a propensity score. Under this approach, a particular firm *i* from group 0, whose propensity score is (x_i), is paired with a *j* group firm whose propensity score (x_j) is the closest one to (x_i).

To create the propensity score (which is actually the probability that each firm belong to group 1 – firms under financial constraints), non-linear logistic and probabilistic regression methods (Logit and Probit) were considered. In these regressions, the estimated value of the dependent variable assumes only values between 0 and 1 (Wooldridge, 2000): $[0 < \hat{Y}_i < 1]$ For each firm *i*, the value $\hat{Y}_i$ is the probability that this firm belong to or is allocated in group 1 due to its characteristics, namely:

$$\hat{Y}_{i,t} = P\left[FIN\_CONST_{i,t} = 1 \,\middle|\, f(W_{i,t})\right] \quad (7)$$

where P is the notation used to indicate the probability and $FIN\_CONST_{i,t}$ is the dummy of financial constraints, i.e. equals 1 if firm *i* is allocated under the constrained cluster in period t and 0 otherwise. In turn, $W_{i,t}$ is a vector of characteristics of firm *i* at time *t*.

It is crucial to realize that the W vector should not include variables of size, distribution and participation in the Bovespa Index; if so, the pairing would be biased, since those are precisely the characteristics defined as criteria for creating the constraint dummy. Thus, the Probit/Logit regression considered all characteristics of the firm to which we had access, except those used as criteria for the formation of clusters (size, distribution and participation in the Bovespa Index).

STATISTICAL POWER OF TESTS

Shyam-Sunder and Myers (1999) criticized the statistical power of the tests used to verify debt levels based on Trade-off and POT. According to them, no one has been concerned about the possibility of the firm seems to act as recommended by POT, but its behavior actually is pursuing a trade-off. Similarly, it is not tested whether a

behavior accordingly to POT could generate results that seemed to be in search for an optimal level of investment.

The authors proposed, therefore, a test that took into consideration those possibilities. The procedure used simulation data from each of the theories empirical regression, creating "hypothetical" or artificial samples. Thus, a path of leverage was constructed for each firm as if they acted exactly as expected according to a given theory. The simulated data were then placed in the functional form of the other theory, and its validity was verified. If the test validated the theory, there was evidence that it could hold even if firms' debt accurately followed the path advocated by the alternative one. In this case, the data corroborated both theories.

A first problem to be fixed in this paper arises from the fact that Shyam-Sunder and Myers (1999) used functional forms that have the same dependent variable – change in debt level (ΔD_{it}) – while in this paper a DTO functional form adapted for Flannery and Rangan (2006) was applied, in which the dependent variable is the debt ratio at the period immediately after the independent variables are observed ($D_{i,t+1}$) and debt variation is the dependent variable used only in POT equation.

In order to not confuse the notation from now on, a distinction will be made. D_{it} denotes the absolute value of debt level of the firm *i* in period *t* and DL_{it} denotes the debt ratio of the firm *i* at time *t*.

SIMULATING DATA FROM DTO EQUATION

Simulation data from the DTO equation is more direct than from POT one. For this procedure, the debt simulated values are exactly the estimated value of the dependent variable, carried out from the firm's characteristics and the inertial component created by adjustment costs. Thus:

$$\widehat{DL}_{i,t+1} = \hat{\beta}_{DTO}.\hat{\gamma}.X_{it} + \left(1 - \hat{\beta}_{DTO}\right).DL_{i,t} \quad (8)$$

Where DL means Debt Ratio, i.e (D/Total Asset). The simulation is conducted according to the regression that was considered the "best one" among the Trade-off options tested by the AIC and BIC criteria. Estimated values of ($\beta_{DTO} * \hat{\gamma}$) and (1- $\hat{\beta}_{DTO}$)are those shown in Table 6. After that, the simulated values of debt were multiplied by the observed value of total assets in order to obtain values for the simulated debt in absolute terms:

$$\widehat{D}_{i,t} = \widehat{DL}_{i,t} * Total\ Asset_{it} \quad (9)$$

The last step of the simulation was to consider the variation. Again actual values were used. Thus:

$$\widehat{\Delta D}_{i,t} = \widehat{D}_{i,t} - D_{i,t-1} \quad (10)$$

The empirical test of the POT using simulated data from DTO was made using the functional form in equation (10).

$$\widehat{\Delta D}_{i,t} = \alpha + [\beta_{POT} + (\gamma_{POT}.Dum_{i,t}^{const})].DEF_{i,t} + \mu_{i,t} \quad (11)$$

SIMULATING DATA FROM POT EQUATION

This part of the paper tests whether the data obtained by the theory of POT would validate the alternative theory. Thus, the simulated data must be given by the POT theoretical equation where β_{POT} = 1when considering the standard version of the theory and that β_{irrest} = 1 in the adjusted version. Although there isn't a theoretical value for β_{rest}, this could take positive values between 0 and 1, including the value 0. Empirical tests showed that β_{rest} = 0, and therefore data were simulated using this value. However, this would mean that the debt variation would always be zero for firms under financial constraints. Nevertheless, the intercept α was significant in the regression observed, indicating an autonomous component of the debt variation to the constrained firms.

Putting all this information together, to simulate the debt change of those firms under financial constraints[3] the average variation of each firm's debt ratio was used. Thus, the simulated value for financially constrained firms was:

$$\widehat{\Delta D}_{it} = E(\Delta D_i) = \sum_{t=1}^{T} \Delta D_{it} \quad (12)$$

The variation of debt value for unconstrained firms was simulated according to theory:

$$\widehat{\Delta D}_{it} = 1 * DEF_{it} \quad (13)$$

For the simulated data, the ratio of the absolute value of simulated debt for each period and the observed value of total assets was obtained. Thus, the simulated data were:

$$\widehat{DL}_{i,t} = \frac{(D_{i,t-1} + \widehat{\Delta D}_{i,t})}{Total\ assets_{it}} \quad (14)$$

Finally, in possession of simulated debt data for each period, according to the real

[3]The same firm could be considered constrained for a period, but had no constrained in different dates. First, the average was calculated according to all periods where data were available. However, this average value was computed only in periods when firms were considered effectively financially constrained. If the firm did not suffer the same restriction in any sample period, the deficit value in the period would be used as $\widehat{\Delta D}_{it}$ in (14).

deficit of the firms without financial constraints and the average debt variation found to each firm under constraints, the functional form proposed for the DTO on simulated data via POT could be tested:

$$\widehat{DL}_{i,t+1} = \beta_{DTO}.\gamma.X_{it} + (1-\beta_{DTO}).DL_{i,t} + \mu_{i,t+1} \qquad (15)$$

DATA ANALYSIS

The database used in this paper comprised 613 listed firms observed between the fourth quarter of 2000 and the third quarter of 2013, collected from the Economatica platform. There were also data available on the BM&FBovespa[4] and CVM[5] webpages. The result was an unbalanced[6] panel with a total of 18,176 observations. Importantly, not all variables had available data for all observations, so that, effectively, the tests were done with a smaller number of observations.

The data processing was performed using SPSS Statistics 2.0 and versions 11 and 12 of STATA.

DESCRIPTIVE STATISTICS

Several variables required prior treatment due to the incidence of significant outliers. Table 2 presents the descriptive statistics of leverage dependent variable: $LEVER_{it}$. Some observations were removed, because they exceeded the average in very high levels. Only 15 observations were lost from that procedure. The NO_LEVER variable is formed without the presence of these observations.

Table 2

VARIABLE	OBS	MEAN	STAND. DEV.	MIN.	MAX.
LEVER	18,176	9.31	424.46	0	46,817
NO_LEVER	18,161	1.95	12.52	0	427

Source: Prepared by the authors

[4] www.bmfbovespa.com.br/
[5] www.cvm.gov.br/
[6] The choice made by the unbalanced panel is justified by the presence of survivorship bias that would be created by using only observations that make a balanced panel. It is noteworthy, however, that all equations were also regressed in artificially balanced panels. The balance was made both to the stratum of firms that appear in all periods and in lower temporal strata that would ensure the survival of a greater number of firms. In all cases, the findings were similar to the unbalanced panel, increasing the robustness of empirical testing.

Footnotes for Table 3:

[7] It should be noted that the values of descriptive statistics refer to panel data. Thus, to say that 14.27% of the observations refer to participants in the Bovespa Index does not mean that this is the percentage of the sample that has the value of the dummy equal to 1 (in fact, only 55 of the firms considered belong to the index in the period used as a parameter, i.e. less than 10% of them). The difference occurs because firms whose $IBOV_{it}$ =1 appear in the sample more frequently, i.e., for more periods of time.
[8] Just like footnote 9, the percentage values refer to the panel data, which doesn't allow to infer the percentage of all firms that actually belong to the "New Market" Segment.
[9] Just like footnote 9, the percentage values refer to the panel data, which doesn't allow to infer the percentage of all firms that actually belong to the N1 Segment.
[10] Just like footnote 9, the percentage values refer to the panel data, which doesn't allow to infer the percentage of all firms that actually belong to the N2 Segment.

Several explanatory variables were built for each observation of the sample. Descriptive statistics are provided in Table 3.

Table 3

VARIABLE	OBS	MEAN	STAND. DEV.	MIN.	MAX.
roaop	18,130	-3.78	289.20	-31,976.00	7,885.00
roa	18,130	-4.00	286.00	-31,976.00	5,361.00
marg	18,176	-17.35	477.00	-25,914.00	16,569.00
turn	18,176	29.56	2.10	-14.02	163,654.00
lnrev	18,055	11.00	4.00	-16.70	18.00
lnta	18,176	13.33	2.47	0.00	20.43
lne	18,176	9.65	8.23	-16.13	19.65
mtb	12,239	2.68	12.98	0.00	985.21
varrev	16,397	3.50	194.47	-2,040.60	18,568.18
varta	17,599	66.68	4.625.34	0.99	440,234.70
age	17,478	459.09	318. 58	1.00	1,358.00
ipoage	14,763	239.11	173.31	1.00	945.00
s_ms	13,426	0.02	0.04	0.11	1.00
mgebitda	12,472	-0.80	103.88	-4,512.75	6,581.00
mgop	16,284	-18.95	489.56	-25,779.67	16,372.50
tang	17,182	71.86	5,434.97	6.55E-07	657,179.00
fisc	16,944	-18.39	494.40	-25,914.67	16,568.50
ntax	17,802	1.38	86.42	0.09	6,493.00
sdebitda	15,225	1.73	3.47	0.00	18.06
sdop	16,956	3.97	4.87	0.00	18.29
sales_rev	13,426	0.10	2.74	-222.50	206.00
liqa	18,105	37.41	2,236.15	0.00	219,272.00
volneg	18,176	390,521.00	2327,949.00	0.00	6.70E+07
disp	18,153	0.11	0.15	0.01	1.00
ibov[7]	18,176	0.14	0.34	0.00	1.00
liqb	18,176	8.97E+08	5.71E+09	0.00	9.82E+10
distrib	13,244	3.78	229.90	-9,831.90	17,720.08
vare_rev	17,622	-4.05	633.09	-83,125.80	12,304.00
seg_nm[8]	18,176	0.21	0.40	0.00	1.00
seg_n1[9]	18,176	0.07	0.25	0.00	1.00
seg_n2[10]	18,176	0.03	0.16	0.00	1.00
conc1	11,811	50.47	37.98	0.00	100.00
conc2	11,810	64.24	38.44	0.00	100.00
riskfree	18,176	0.01	0.00	0.00	0.01
retibov	18,176	0.17	0.39	0.41	0.97
expol	18,176	0.59	0.49	0.00	1.00
varbonds	18,176	1.91	4.68	0.79	14.73
retstock	9,791	7.59	62.33	-87.94	4,342.71
quald	18,176	0.33	0.46	0.00	1.00
kd	17,449	9.13	825.68	-295.60	105,256.40
dum_Bndes	18,172	0.08	0.27	0.00	1.00

Source: Prepared by the authors

Regarding corporate governance proxies, it is noteworthy that 21.2% of the observations are firms that participate in the "New Market" segment, 7.16% are in N1 segment and 2.84% in N2 segment. In addition, the average concentration of Brazilian listed firms in the sample is around 50% by the criterion of shareholders marked as "controlling group" and 64% by the criteria of shareholders with at least 5% of firm's stocks, indicating concentration and a low level of corporate governance in the sample. 8% of the firm-time sample observations had received BNDES resources in this sample.

DYNAMIC TRADE-OFF

Estimating the DTO model, the methodology proposed was panel data regression. It is essential to present the traditional tests for the presence of non-observed effects, able to create bias in the estimated coefficients. Besides, due to the large number of variables under investigation, the generation of factors was used, considerably reducing the variables dimension. Moreover, high correlation of proxies that were designed to determine the same characteristics also justifies the creation of orthogonal factors.

FACTOR ANALYSIS

The statistical package IBM SPSS Statistics 20 was used to generate factors. The final estimation was chosen with 9 factors whose explanation of cumulative percentage of the total variance of original variables was 48.66%. The KMO[11] statistic was 0.611, indicating that those factors had good explanatory power on the variables set. Note also that, building the factors, all variables with an unavailable value were replaced by the average of the sample; so each factor has all the observations (18,176).

Table 4 shows the result that was rotated by the Varimax method, and participating components in each of the factors, allowing factors to be named according to them.

Factor 1 is formed by the three variables of accounting results (net earnings, operating revenues and EBITDA[12]), and the variable taxes benefits. We named it 'free cash flow' (regressor: $F1\_FCF_{it}$).

Factor 2 has three main components as size proxies, in addition to dummies of participation in the Bovespa Index and in the New Market segment of the BM&FBovespa. It was named 'size' factor ($F2\_SIZE_{it}$).

Factor 3 has the liquidity variables on the stock exchange and turnover in the market and the value of the factor is higher for firm-time with most liquid negotiations. It also has as positive components $LNTA_{it}$, a size proxy, and the market share (S_MS_{it}), also representing more established firms. Finally, dummies IBOV and N1 market segment are also representative. This factor therefore represents firms considered "bluechips", being named $F3\_BLUECHIPNESS_{it}$.

[11]Kaiser-Meyer-Olkin
[12]Earnings Before Interest, Taxes, Depreciation and Amortization.

Factor 4 is formed by positive components of non-debt taxes benefits (from depreciation and amortization), turnover and asset tangibility. A higher proportion of tangible assets accounts for a higher depreciation rate. The turnover variable, however, has total assets as the denominator, so firms whose assets are higher should have lower turnover. Two possibilities were raised: the first one is that there may be a negative relationship between profitability and tangibility, that is, firms that have higher returns are precisely those whose fixed assets are less relevant. The result observed in the factor 5 helps to corroborate this hypothesis. Another phenomenon that could contribute to the positive association between turnover and tangibility of assets is that the revenue of firms grows more than proportionally to the variation of fixed assets. In fact this occurs with 54.3% of the sample. Factor 4 was named $F4\_TANG_{it}$.

Factor 5 has positive components for the variables of return on assets (measured by operating revenues and net earnings), indicating that it is a profitability proxy. The negative component $VARE\_REV_{it}$ seems to indicate that firms have higher returns also because they use less equity financing. The negative component of asset tangibility, on the other hand, indicates that firms with higher profitability are those able to generate higher returns with less immobilization of assets, a result similar to that observed in the factor 4. The factor 5 was called $F5\_PROFIT_{it}$.

Factor 6 has ownership concentration components, setting up a corporate governance proxy. It was named $F6\_STCONC_{it}$.

Factors 7 and 9 are best analyzed together, as their main components were the proxies for windows of opportunity. For factor 7, the negative component of the Selic rate (lower interest rates), plus the increase of issuance of debentures, coupled with a negative return of the Bovespa Index, points to a hot market for debt issuance. In addition, the presence of components participation in the New Market segment and higher availability of resources indicate that the factor does not consider only the market characteristics, but also the firms' suitability to benefit from the window of opportunity that presents itself. The factor was named is F7_hotmktdebt.

As for the factor 9, the positive components of expansionist government policy (which implies a higher expectation of firms' growth) and returns of Bovespa Index and of firm's stocks point to a hot market of stocks. Then it is the F9_hotmktstock factor.

Finally, the factor 8 is represented by the high variability of the firm's returns measured by the standard deviation of operating revenues and EBITDA, in addition to the component of debt quality (higher financial cost of debt). It is therefore an operational risk proxy: $F8\_RISK_{it}$.

Table 4

	1	2	3	4	5	6	7	8	9
Marg	0.983								
Fisc	0.983								
Mgop	0.972								
Mgebitda	0.481								
Sales_rev									
Lnta		0.835	0.301						
Lnrev		0.764							
Lne		0.721							
Seg_n2									
LiqB			0.833						
Volneg			0.803						
Ibov		0.413	0.526						
Seg_n1			0.490						
S_MS			0.474						
Varta									
Ntax				0.963					
Turn				0.959					
Tang				0.498	-0.365				
Roaop					0.974				
Roa					0.962				
Vare_rev					-0.313				
Conc2						0.951			
Conc1						0.945			
Riskfree							-0.804		
Varbonds							0.657		
Seg_NM		0.313					0.475		
Disp							0.387	-0.358	
Varrev									
Sdop								0.643	
Sdebitda								0.616	
Quald								-0.545	
Distrib									
LiqA									
Expol									0.792
Retibov							-0.379		0.747
Retstock									0.361
MtB									
Kd									
Age									
Age2									
Ipoage									
Dum_Bndes									

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Source: Output from SPSS

The reduction of dimensions by factors was accomplished without significant loss of information. Proxies designed are free cash flow, size, market liquidity, asset tangibility, profitability, concentration structure, windows of opportunity to issue debt and stocks, operational risk, i.e. almost all firm features this papers aimed to test. Some variables, however, did not end up being incorporated by any factor. Among them, there are the three growth opportunities proxies considered important for the agency costs and life cycle theories, $SALES\_REV_{it}$ (singularity), $DISTRIB_{it}$ (distribution), $LIQA_{it}$ (accounting liquidity), the financial cost of debt variable (KD_{it}) and age of firms. These variables were then included separately in the regressions. The same can be said about the dummy that indicates receiving funding from BNDES. For growth opportunity proxy, we excluded the possibility of using market-to-book, because of the incidence of outliers, and the best option was $VARTA_{it}$.

Before presenting the panel data regressions themselves, it is important to note that, even using factors instead of original variables, there is intra-firm and inter-firm data variability. Tests[13] showed that the standard deviation values were not reduced considerably with the factor analysis procedure. The worst case scenario occurred at F3 factor, in which the standard deviation inter-firms reduced to 1/3 of the observed for the original sample. Still, there was sufficient variability and thus factors could be used for the panel regressions.

PANEL REGRESSION FOR DTO

Panel regressions were performed on the functional form adapted from Flannery and Rangan (2006). Table 5 presents the results of regressions performed with all the variables proposed (9 factors, $SALES\_REV_{it}$, $DISTRIB_{it}$, $LIQA_{it}$ KD_{it}, $VARTA_{it}$, AGE_{it} and DUM_BNDES_{it}). Columns (1) and (3) included the lagged leverage variable, which was excluded from the regressions shown in columns (2) and (4). The explanatory power of the fixed effects models and pooled OLS were highly increased with this inclusion, as seen by the R^2. Besides, the coefficients of NO_LEVER_{it} variable are close to 1, without, however, reaching this value, indicating that there is some space for management in search of optimum debt.

[13]Omitted in this paper. They can be obtained directly from the authors.

Table 5

VARIABLES	(1) FE	(2) FE	(3) POLS	(4) POLS
no_lever	0.743***		0.893***	
	(0.123)		(0.118)	
Constant	-1.256**	-6.086*	0.322*	1.943***
	(0.599)	(3.513)	(0.171)	(0.202)
Observations	8,507	8,507	8,509	8,509
R-squared	0.531	0.011	0.729	0.060
Number of n:	425	425		

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

Source: Prepared by the authors

An analysis of the observed signals in variables from Table 5 is not possible, since the vast majority of incorporated explanatory variables were not significant. The stepwise procedure was adopted to choose a regression that best suited to data with greater explanatory power. The procedure started with the most complete model where all the explanatory variables were included (9 factors and variables that did not join any factor). Then non-significant variables were withdrawn gradually until a regression where all variables were significant could be found, according to the traditional levels of significance. Table 6 shows this regression. Regression methodology for fixed effects is justified by the Hausman test (p-value = 0.0000).

Table 6

VARIABLES	FE
No_lever	0.933***
Sales_rev	0.008***
LiqA	2.09e-06***
Kd	-4.33e-06***
Age	0.00179**
Roaop	0.004**
f4_tang	-0.136*
Dum_Bndes	-0.212**
Constant	-0.677*
Observations	12,171
Number of n:	437
R-square	0.740

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

Source: Prepared by the authors

Noteworthy is the high value of R^2, demonstrating the great power of explanation of the explanatory variables used. Besides, the coefficient found for the lagged dependent variable (0.93) indicates a β_{DTO} = 0.07 and supports the dynamic trade-off theory with relevant adjustment costs. It leads to the conclusion that firms adjust 7% per quarter towards their goal. Flannery and Rangan (2006) report finding coefficients around 0.75 (25% adjustment), but it's important to face that most of the previous studies also provided results close to the 5%-10%, as found in this study for Brazilian publicly traded firms. Also, 7% is a high level of adjustment in just a quarterly basis. Before interpreting the coefficients, it is important to keep in mind that the vast majority of firms' debt in Brazil is still bank basis.

The positive sign of $ROAOP_{it}$ profitability proxy[14], is similar to that found by most previous studies (Shyam-Sunder and Myers, 1999). Besides being the signal expected by the Trade-off theory, it also supports the POT under financial constraints.

The AGE_{it} variable is also positive, indicating that the debt grows in more mature firms. Most regressions have shown that $AGE2_{it}$ variable (quadratic form) was not significant, and so did this.

The negative coefficient found in $F4\_TANG_{it}$ factor can be explained by the factor components, including the one with the highest coefficient in the factor: $NTAX_{it}$ variable, whose expected sign is negative (the higher the benefits earned by depreciation and amortization, the lower the debt for taxes benefits purposes).

The positive association of debt with the accounting liquidity $LIQA_{it}$ and negative with the financial cost of debt KD_{it} agree with what would be expected. However, the positive sign of singularity proxy $Sales\_Rev_{it}$ is not according to expected and may indicate that singular firms use more bank basis debt.

The dummy variable for BNDES financing indicates that firms that use more bank basis debt receive less funding from the Developing Bank. This can be a sign of financial constraints faced by those firms.

Altogether, those results indicate that firms that use more bank basis debt in B razil are constrained ones: higher singularity, higher accounting liquidity reserve, older, facing higher earnings and using them to attract more debt, with less tangible assets to use as collaterals and less access to subsidized debt from BNDES.
The estimated equation for the determinants of debt according to the Dynamic Trade-off can be written as follows:

[14]It was noteworthy to mention that, since a factor was not significant in the regression, each of its components were separately tested on it. So, as Factor 5 was not significant in DTO regression but ROAOP (one of its components) was, this variable appears in the regression.

$$LEVER_{t+1} = -0.672 + (0.930 * NO\_LEVER_{it}) + (0.008 * SALES\_REV_{it}) + (2.09e^{-6} * LIQA_{it}) - (4.33e^{-6} * KD_{it}) + (0.018 * AGE_{it}) + (0.004 * ROAOP_{it}) - (0.136 * F4\_TANG_{it}) - (0.0212 * DUM\_BNDES) \quad (16)$$

The POT regression consists in using the functional form adapted from Shyam-Sunder and Myers (1999), considering the role of financial constraints (from the construction and use of a dummy in the equation) and a proxy for the intended investment of the financially constrained firms. The constraint dummy construction was made from the cluster analysis method, while the intended investment came from matching firms under constraints to those that did not suffer such restriction. Finally, the data were applied in the traditional panel regression.

CLUSTER ANALYSIS – FINANCIAL CONSTRAINTS DUMMY

Three firm characteristics were taken into account to generate the clusters for the financially constrained firms – size, dividends distribution and participation in the Bovespa Index. In addition, in order to avoid variations coming from temporal matters (as crisis, expansionary or contractionary policies) that could alter the outcome, the groups were created year by year.

The size is represented by $F2\_SIZE_{it}$ factor, as constructed from factor analysis. The dividends distribution is represented by the variable $DISTRIB_{it}$ which is the sum of dividends and interest on equity paid. However, due to the high incidence of outliers, that also moved the centroid of the formed clusters, some outliers (far from average by at least one standard deviation) were removed from sample. The variable adopted then was called $NO\_DISTRIB_{it}$ (no outliers dividends).

The third characteristic adopted is the Bovespa Index dummy, that assumes value 1 for the firms that participated in the index and 0 for the others.

In practical terms, for each year, two steps were taken. In the first stage, clusters were made only according to size and dividends paid. In the second step, clusters were formed also including the Bovespa Index dummy ($IBOV_{it}$). The $IBOV_{it}$ standardized variable was used, first with a standard deviation equal to 1. If this result has shown an excessive weight, the result was then discarded and the procedure repeated, but now with a new standardization of dummy variable, which takes standard deviation of 0.75. If necessary, this value could be further reduced to 0.5. There wasn't any year where a further reduction was needed.

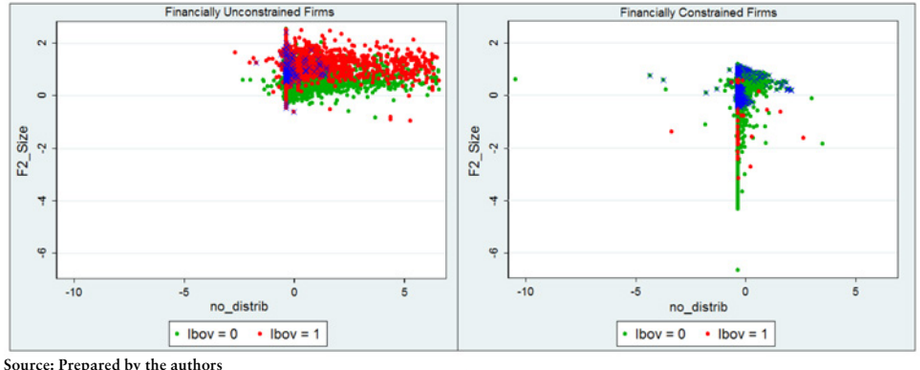
The graphics in Figure 1 present the observations that were allocated in each group. On the left, the largest firms and with higher dividends distributions are considered financially unconstrained. A lot of those firms were in the Bovespa Index (in red).

The right graph in Figure 1 contains the group of financially constrained firms. Some firms in this group also participate in Bovespa Index, although it only happens in a small number of observations. In these periods, those firms presented themselves so small-sized and distributed so little dividends that, even participating in the Bovespa Index, they were unlike to be considered non-financially constrained.

Dots marked with the blue X on the graphs refer to the firm-time observations that have changed groups after considering $IBOV_{it}$. Although *a priori* some firms have been considered in a certain group, they were relatively close to the borderline between the clusters in Euclidean space; so after step two, those firms were moved to the other group.

Table 7 shows the average of the variables in each cluster (formed by the first and second stage of the construction process). Firms of group 0 are considered financially unconstrained, as they are larger and distributed more dividends, and they also have much higher percentage of participants in the Bovespa Index. Group 1 firms are considered more likely to be constrained, because they are smaller, distributed less dividends and only a tiny part of them participated in the Bovespa Index.

Figure 1



Source: Prepared by the authors

Table 7

	CLUSTER	F2_SIZE	NO_DISTRIB	IBOV
Financially Constrained (with IBOV)	0	0.67	0.22	0.26
	1	-0.60	-0.31	0.01
Financially Constrained (without IBOV)	0	0.61	0.19	0.22
	1	-0.63	-0.31	0.05

Source: Prepared by the authors

PROBIT/LOGIT – INTENDED INVESTMENT MATCHING

Once in possession of the constraint dummy, we could proceed to the next step: the construction of the deficit variable. To do this, however, we still had to determine the intended investment of all firms in the sample. Those whose value of the dummy of financial constraint was zero were assumed to invest exactly what they want, so we just used their actual investment, which chosen proxy was the variation of fixed assets.

Financially constrained firms, however, can only invest below their claims due to the financial constraints. For the intended investment proxy of these firms we use the variation of fixed assets of some other firm, financially unconstrained and considered similar to it. Thus, each firm whose financial constraint dummy had value 1 was matched with a firm that did not suffer from the financial constraint problem and the value of the intended investment of the second one was used as a proxy for the intended investment of the first one. The pairing criterion was the proximity of the "propensity coefficient", calculated from nonlinear regressions Probit or Logit.

Table 8 shows the result of those regressions. The estimated value of the dependent variable of the regressions is interpreted as the probability that firm *i* at time *t* is financially constrained, due to the characteristics considered in the vector of explanatory variables (Wooldridge, 2000). In other words, it is a firm's propensity coefficient to be allocated or to belong to Group 1 in a given period. The results show that the more leveraged firms, riskier, with higher degree of singularity, higher profitability and also the oldest ones are more likely to be financially constrained (positive sign). About the F5_PROFIT factor, it is noteworthy to mention that this factor is not just composed of return on assets, but also has as negative components tangibility. This indicates that the profitability of these firms is associated with a lower amount of fixed assets (low collateralization). Interestingly, singularity, age, profitability were also characteristics associated with a higher use of bank basis debt, while tangibility was associated with a lower use of bank basis debt in DTO estimation (15), corroborating the fact mentioned in 4.2.2 that firms with higher level of bank basis debt are the constrained ones.

The negative sign of the other variables shows that bluechipness and firms with greater tangibility and accounting liquidity are less likely to be considered constrained (according to this estimation, accounting liquidity reserves are relieving the firms' former constraints). Moreover, it is interesting to note that the result shows that the constraint is less likely at times when the debt issuance market is heated.

Table 8

	(1)	(2)
VARIABLES	PROBIT	LOGIT
Lever	0.339***	0.563***
f3_bluechipness	-0.217***	-0.350***
f4_tang	-1.143***	-1.920***
f5_profit	8.505***	14.280***
f7_hotmkt_debt	-0.084***	-0.179***
f8_risk	0.131***	0.215***
Sales_rev	0.188**	0.347
LiqA	-9.73e-05***	-0.000**
Age	0.000***	0.000***
Constant	-0.578***	-0.995***
Observations	8,641	8,641

Robust standard errors in parentheses
***p<0.01 **p<0.05 *p<0.1

Source: Prepared by the authors

We chose to use the Probit regression coefficients (althought Logit coefficients totally agree with Probit ones). The criterion adopted was the following: the estimated values of the dependent variable of the regressions in Table 8 were saved. Then, we performed similar Probit and Logit regressions, in which the explanatory variables used were the same as those adopted as criteria in clusters formation, i.e. $F2\_SIZE_{it}$, $NO\_DISTRIB_{it}$ and $IBOV_{it}$. Estimated values were also saved as propensity scores. Finally, the square sum of the differences between scores of each firm was calculated, being the smaller those under Probit regression, which was then chosen.

PROBIT/LOGIT – INTENDED INVESTMENT MATCHING

Finally, in possession of financial constraint dummy and intended investment proxy for both financially constrained and unconstrained firms, the deficit variable was created and tested in the functional form proposed to POT by Shyam-Sunder and Myers (1999).

Table 9 shows the regression results. The dependent variable is the variation in debt amount (in absolute terms), while the explanatory variables are the deficit proxy (adapted to intend investments of constrained firms by the propensity score method) and the same variable multiplied by the financial constraint dummy. Besides, the BNDES credit resource dummy was also included. It is worth mentioning that Breusch-Pagan test (p-value = 0.0000) and Hausman (p-value = 0.0000) were used for choosing the fixed effects regression as the consistent one.

Table 9

VARIABLES	POT
Deficit	1.295***
Dum_Deficit	-1.277***
Dum_Bndes	-148,528*
Constant	-244,238***
Observations	8,223
Number of n:	425
R-squared	0.586

Robust standard errors in parentheses
***p<0.01 **p<0.05 *p<0.1

Source: Prepared by the authors

The coefficient found overcame slightly the value expected by the theory. However, the Wald test applied under the null hypothesis (H_0 of $\beta_{POT} = 1$) showed a p-value of 0.1002, which implies that the null hypothesis is not rejected by traditional levels of significance, supporting the POT for firms that do not suffer constraint: $\beta_{irrest} = 1$.

The next step is to evaluate the result for firms under financial constraint. By the definition: $\beta_{rest} = (\beta_{POT} + \gamma_{POT})$, where the value observed for γ_{POT} in the regression was significant and negative as expected, indicating that the coefficient for firms under constraint is not the same of that for other firms, i.e. their decisions about capital structure are driven by different objectives. Again we applied the Wald test in order to observe the statistical significance of the coefficients. In this case, $H_0: \beta_{POT} + \gamma_{POT} = 0$ and $H_1: \beta_{POT} + \gamma_{POT} \neq 0$. The p-value of 0.738 was found, i.e. the result is highly significant, from which follows that, in fact, the deficit variable has no statistical significance in determining the variation of the debt contracted by financially constrained firms. In other words, we do not reject the hypothesis that $\beta_{rest} = 0$. The results corroborate with the hypothesis that the debt variation of financially constrained firms is not determined by the deficit and the intended investment of those firms. The managers' behavior then must be directed by other issues, since their main goal may be to get rid of the constraint itself.

It's also worth to notice the BNDES dummy role in the regression. The negative sign found means that firms that access these subsidized credit funds really use less regular bank basis debt in order to finance their deficits. An investigation of the role played by BNDES is beyond the goals of this paper and is left to a subsequent work.

The estimated equation according to POT was:

$$\widehat{\Delta D}_{it} = -244{,}238 + [1.294 - (1.277.Dum_{i,t}^{rest})].DEF_{i,t} - 148{,}528.Dum\_Bndes \quad (19)$$

where $Dum_{i,t}^{rest}$ assumes value 0 for firms without financial constraints and 1 for firms under constraints.

STATISTIC POWER OF TESTS

The last step of the proposed procedure consists in accessing the power of each regression. As Shyam-Sunder and Myers (1999) proposed, the tests created "artificial" debt path from DTO and POT estimated equations, which will be tested in reverse functional form (DTO simulation data tested in the POT equation and POT simulation data tested in DTO equation). The goal is to test if a theory could be proven true even when simulated data come from an alternative theory.

First, debt levels were simulated from the estimated equation of adjusted POT. These data were tested under functional DTO form. Second, the debt ratio was simulated from the estimated equation of DTO. The simulated data were then tested under the functional form of the adjusted POT.

DTO REGRESSION USING DATA SIMULATED FROM ADJUSTED POT

Analyzing Table 10, column (5) presents evidence that, using data simulated from adjusted POT, there are still adjustment costs, so that the relocation of the debt level would not be instantaneous, but leave room for some mobility, defined according to certain characteristics of the firm. However, using the simulated data and considering financially unconstrained and constrained firms theoretical behavior (debt variation equal to 100% of deficit for the first ones and equal to 0% of deficit for the second ones), the inertia is not as big as before, with 14% of adjustment every quarter. We assume that, as POT simulated data are more precise for unconstrained firms (as for the constrained ones we used average debt variation), the lower inertia is revealing the behavior of the unconstrained firms.

In accordance with former DTO equation (in 16), from the stepwise procedure[15] it is see again that firms with higher tangibility, lower cost of capital and more willing to access a hot market of public debt use less bank basis debt. In this regression, we suppose BNDES access has been replaced by the hot market of public debt. About the profitability factor (F5_profit) is is important to mention it carries on tangibility as a negative component, while in equation 16 we used return on assets only (not the factor) as a proxy for profitability.

Looking carefully, those results indicate that firms contract more bank basis debt to finance their deficits (unconstrained ones) or contract the average amount of debt

they are allowed to (constrained ones), as long as they face lower tangibility, lower cost of debt and since there is not an alternative market for debt (as a hot market for public debt issuance).

Table 10: DTO regressions using data simulated from adjusted POT

	(1)	(2)	(3)	(4)	(5)
VARIABLES	FE	FE	POLS	POLS	FE_STEPWISE
no_lever	0.95***		1.08***		0.82***
f1_fcf	-0.06	0.17	-0.27	-0,416	
f2_size	-0.37	-3.59*	-0.28	-3,478***	
f3_bluechipness	0.17	-0.43	0.01	0,149**	
f4_tang	0.46	1.48*	0.04	0,745***	-0.06***
f5_profit	-11.69	-31.41*	-2.64***	-14,16***	-0.16**
f6_stconc	0.08	-0.08	-0.01	-0,0649	
f7_hotmkt_debt	0.45	0.58	-0.05	-0,152	-0.29*
f8_risk	-0.40	-0.93	0.03	0,0700	
f9_hotmkt_stock	-0.01	0.09	0.00	0,338**	
Varta	0.49	0.34	0.30	0,267	
Sales_rev	-0.01	-0.02	-0.04	-0,280**	
LiqA	-7.41e-07	4.66e-06	1.47e-06	7,44e-06**	
Distrib	0.01	0.00	-0.01	-0,00642***	
Kd	-9.83e-06	1.50e-05	-2.85e-06	3,90e-05***	-7.31e-06*
Age	0.01	0.02*	-0.00	-0,000816*	
Dum_Bndes	-0.02	-0.50	0.06	0,703***	
Constant	0.01	-6.28	0.23	2,282***	0.31
Observation	7,603	7,603	7,603	7,603	9,335
R-squared	0.44	0.02	0.62	0.05	0.41
Number of n:	422	422			483

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

Source: Prepared by the authors

POT REGRESSION USING DATA SIMULATED FROM DTO

Table 11 shows the regression results of the functional form of the POT applied to simulated data from DTO. This time, under estimation (1), the Wald test rejects the null hypothesis that (Deficit = 1), with p-value = 0.03. However, at this estimation, the BNDES dummy was not significant. For the simulation made without considering the BNDES dummy (estimation 2), Wald test presents p-value = 0.33, thus not rejecting the POT theory just as Shyam-Sunders and Myers have found on their own paper.

Also, the hypothesis that (Deficit + Dum_Deficit = 0) is not rejected, since the p-value observed for the Wald test is highly significant (0.94) under estimation (2).

[15] The p-value was 0.0000 for the Hausman test in all three regressions proposed (all characteristics with and without "no_lever" and the "stepwise regression").

We can conclude, therefore, that considering that firms contract debt accordingly to DTO, they seem also do so considering their deficits (if they are unconstrained) or the average availability of financing (if they are constrained ones).

Table 11: POT Regression using Simulated data from DTO

	(1)	(2)
VARIABLES	POT	POT
Deficit	1.399***	1.336***
Dum_Deficit	-1.436***	-1.371***
Dum_Bndes	-125,219	
Constant	-228,482**	235,498**
Observations	7,871	8,224
Number of n:	422	425
R-squared	0.541	0.218

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

Source: Prepared by the authors

CONCLUSION

The main conclusion stated here indicates that theories based on Trade-off and Pecking Order, from the perspective of financial constraints, are complementary. Both theories are supported by the proposed empirical tests and, furthermore, their validity was not affected by the stress test proposed. Therefore, we can conclude that firms behave according to both theories, that is, they issue debt when they need capital to overcome their deficit (unconstrained ones) or as far as they can (constrained ones). Additionally, when firms actually seek to raise funds in a regular bank basis debt market, they contract more as long as there is no alternative (as a hot market for public debt issuance or subsidized loans from BNDES), the lower is the cost of funding and the lower is their degree of tangibility (less collaterals).

Therefore, as far as the sample indicated, it was possible to valid both theories analyzed. For the theory of the DTO, according to the procedure adopted in Flannery and Rangan (2006), adapted to incorporate a lot of the relationships based on Trade-off, plus corporate governance proxies, it was possible to demonstrate that, despite the presence of relevant adjustment costs (7% per quarter adjustment), there seems to be a firm's tendency to allocate debt ratio toward an optimum level.

The POT, adjusted to incorporate the role of financial constraints in the financing decision of the firms, was also validated for the sample of Brazilian publicly traded firms. In this case, it was observed that, for firms that do not suffer from financial constraints, the debt variation was related to their deficit in a proportion

of 1 to 1, just as would be recommended by the original version of the theory. Firms suffering financial constraints, however, could only undertake part of the investment opportunities that present to themselves. For this reason, concerned not only with the present investment, but also with future ones and, in particular, seeking to escape from the constraint situation, they seem to behave differently. The results found for these firms show that the change in their debt level is not at all even related to the deficit, so totally unexplained by the original theory of POT.

Adapting the functional forms for inclusion of a wider range of relationships in the equation of DTO, incorporating the role of financial constraints by POT and validating both theories from the simulated data provide evidence that coexistence is possible between otherwise incompatible theories.

For the equation of DTO, we found that firms that use more bank basis debt in Brazil are the constrained ones: higher singularity, those that need to keep a higher accounting liquidity reserve, older, facing higher earnings and using them to attract more debt, with less tangible assets to use as collaterals and less access to subsidized debt from BNDES. In this study, there was a gap left by the statistical insignificance of corporate governance proxy, therefore it was not possible to define whether this would a substitute or a complementary mechanism to debt according to the theories addressed.

Another interesting question that ended up not being addressed in the data refers to growth opportunities proxies. Widely used by the literature, this variable wasn't drawn to any factor. We attempted to use variable $VARTA_{it}$ as a proxy, but it was not statistically significant in any of the analyzed regressions. Thus, this important component of the life cycle and agency costs theories ended up being excluded from this empirical analysis.

For the functional form of the adjusted POT, it was proposed a very specific methodology, which considered both generating financial constraint dummy and a matching methodology for pairing up firms and establishing intended investment proxies for constrained ones. The matching method to pair up firms and to create proxies for intend investments is a positive proposal. A problem that occurred from this procedure is that it didn't take into account the year and the sector of the firms. The database, however, proved to be very incomplete for the use of more complex procedures, so that in many cases there was not at least one "unconstrained" firm in some stratum. Even considering only one criteria, year or sector, pairing up proved impracticable, since the options would be drastically reduced and the sample would have a lot of repeated data to the intended investment amount.

Finally, a very interesting result found in this paper was the pattern brought by the BNDES financing role. A first diagnosis showed that having access to the Developing Bank reduces the amount of bank basis debt raised by firms.

A contribution of this paper is a broader understanding of Brazilian publicly traded financing behavior under financial constraints

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