The Effects of Corporate Bonds on Employment: Early Evidence from Greece

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This study investigates the impact of corporate bonds issued by Greek listed firms on employment. Even though external financing and the effects on employment has been studied in the literature, we extend the existing literature by focusing for the first time on the specific role of corporate bonds on employment. Our empirical analysis is based on a panel dataset from 2001 to 2014 and we examine the effect of corporate bonds in the pre and post period of the Greek economic crisis, in which the banking system is vulnerable and unable to provide financing to the firms. The results suggest that corporate bonds have a positive effect on employment in the pre-crisis sample, denoting that firms hire employees and proceed to investment choices. On the contrary, during the recession, corporate bonds have a negative effect on employment. Firms reduce their costs and try to control their debt obligations by issuing corporate bonds.

1   Introduction

The paper contributes to the empirical literature understanding corporate debt and its effect on employment. Although external financing became considerably popular in recent years with a number of studies that look at the relationship among employment, external financing, leverage, size and other factors, corporate bonds have received little attention in the academic literature.

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We go one step further and we examine for the first time their effect on employment during poor domestic economic conditions.

The recent financial crisis highlights the importance of understanding how financial market conditions impact the real economy. After 2008, when the global economic crisis started, European firms had unsustainable debt and corporate investments declined sharply. The largest falls incurred in the E.U. periphery like Greece, Ireland, Spain, Italy, Estonia, Slovenia, Lithuania, while Germany, Netherlands and Austria remained almost unaffected. Greece was hit hard by the recession, which affected companies in a negative manner to borrow funds from the banking system and that had an impact on their operational behavior due to increased financial pressure. In that period, the financial distress of Greek firms was in the highest levels and financial institutions couldn't provide funding into the real economy, because they had been under pressure to shrink their balance sheets (high-risk exposure on their portfolios of Non-Performing Loans), while at the same time the deleveraging of the Greek economy continued. Until the complete restoration of Greek banks to their market-making role, firms had an access to alternative, more diverse source of funding "corporate bonds", that could use the proceeds from bond sales to invest in growth and job creation. Therefore, this study deals with an interesting case study of an economy entering a financial crisis and as such it could help us understand corporate behavior in such conditions.

The rest of our study is arranged as follows: Section 2 reviews the related literature; Section 3 presents the sources of the collected datasets; Section 4 introduces the methodological approach; Section 5 presents and discuss the empirical findings; Section 6 presents the robustness analysis; Section 7 concludes the main insights of our paper and provide some remarks.

2 Background and Related Studies

Firms frequently make decisions about the composition of their capital structure. The first who examined this issue were Modigliani and Miller (1958). They formed the basis for modern thinking on capital structure. Under specific assumptions a firm is unaffected by how that firm is financed. When the interest on debt is tax deductible, and ignoring other frictions, the value of the company increases in proportion to the amount of debt used, so firms prefer to issue debt instead of equity.

Divergences from this study, described by Donaldson (1963), Jensen and Meckling (1976), Myers (1977), Myers (1984), Myers and Majluf (1984), Fama and French (2002) have emphasized the role of informational asymmetries and agency costs that differentiate the cost of external and internal financing, making capital structure choice important for the firm's value and for the cost of capital available to the firm. This has implications for the real side activity of the firm such as employment and investment in inventories.

An alternative theory was developed by Myers (1977) regarding the optimal level of debt financing, which is related to the types of assets in their portfolio (growth or equity assets). Firm's investment decisions are distorted if creditors capture large part of investment's cash-flows. Firms with risky debt will follow a different investment rule than those that issue equity. The decisions of firms to increase their capital either by external financing (issue debt by loan, corporate bond or commercial paper) or by internal financing (capitalize profits or issue new shares) is related to their needs to finance their development program, equipment, specific projects, mergers and acquisitions (M&A), research and development (R&D), infrastructure, establishment or improvement of production lines, new products and services, ongoing operations or even working capital. Therefore, employment is a crucial parameter connected to the operation of firms, so they can generate profits. The objective of business is profitability and every organization's success depend on its employees' performance.

In the late 80s, the financial distress effects of firms were associated with high leverage. However, implications for employment have received little attention. Cantor (1990) studied the effects of leverage on corporate investment and hiring decisions, by using simple econometric models in which the dependent variables are firms' investment and firms' employment growth; the independent variables are current sales, lagged values of sales up to three years and cash-flows. He showed that the effect on employment is more positively correlated with cash flows at more highly leveraged firms. Gertler and Gilchrist (1994) found that sales increase, inventories and bank debt of small manufacturing companies are more sensitive to monetary policy shocks than that of larger companies. In addition, the results suggest that smaller firms have more procyclical employment policies, even after controlling for the greater cyclicality of firms' sales. A statistically significant relationship between firm's financial leverage and employment in the manufacturing sector of US was analyzed by Sharpe (1994) for the period 1959-1985. High leveraged firms tend to lay-off workers, obviously consistent with liquidity constraints.

Hiring of new employees is linked to investment choices and since investment is partly driven by access to finance, employment growth should be partially dependent on external financing. Nickell and Nicolitsas (1999) studied the impact on company behavior of increases in financial pressure and they used three measures of long-term financial constraints: number of employees, dividend payout relative to assets and debt to capital ratio. They suggest that the ratio of interest payment to cash flow is the best measure and when this ratio increases denotes large negative impact on employment and pay rises, but small positive effect on productivity. Heisz and LaRochelle-Cote (2004) investigated the relationship between financial structure and employment growth, as well as investment growth in the Canadian market in 1988-1997. Firms that are financially vulnerable, such as small firms or firms with high leverage, they reduce their labor force more than healthier firms. Especially, during the recession in the 1990-1992

period, the impact was even larger. In the Spanish market, Hernando and Martinez-Carrascal (2008) showed similar results during the 1985-2001 period, based on financial firm-level data and their impact on investment and employment decisions. When the financial pressure of firms increases, then there is a large negative effect on employment. Caggese and Cunat (2008) examined the link between financing constraints of Italian firms and their employment decisions. These firms use fixed-term employees more often when they are under financial pressure, avoiding high firing costs. Pagano and Pica (2012) tested a model on international industry-level data for the period 1970-2003, which predicts that financial development allows firms to increase their use of both capital and labor (employment, wages).

Regarding young and small firms, they experienced a relatively larger decline in net employment growth compared with large firms during the 2007-2009 financial crisis according to Fort et al. (2013). A very interesting approach on the access to external financing and the link to firms' growth is presented by European Commission (2014). A number of channels have been examined to explore the link between financial constraints and employment, by using a labor demand equation augmented with firm financial characteristics for several E.U. states and industries. On average, this report suggest that long-term credit flows have a significant and positive correlation with employment demand. The real effects of access to finance were studied by McLean and Zhao (2014). They showed that both investment and employment are less sensitive to Tobin's q and more sensitive to cash flow during recessions and periods of low investor sentiment. In addition, between share and debt issuance, the authors argue that both play roles in causing these effects, although that share issuance plays a bigger role.

Duygan-Bump et al. (2015) linked credit constraints to unemployment during the 2007–2009 U.S. financial crisis. They showed that the employees of small firms in industries with high external financial dependence are more likely to become unemployed during the recession. Giroud and Mueller (2017) using micro-level data showed that firms with high leverage suffer significantly higher employment losses in response to declines in local consumer demand. Baurle et al. (2017) used a sample of Swiss firms (financial firms and utilities excluded) with firm-level data, in order to investigate the role of financial constraints in employment adjustment. Firms with difficulty to access external funding resize their labor force more strongly than firms that have access to abundant funds, when output decreases. In contrast, financially constrained firms increase their employment more strongly when output increases.

There are also some other studies that examine from another perspective the effects on employment, such as Wadhwani (1987) who investigated the impact of inflation on employment. He showed that higher inflation may be substantially decrease employment. Nickell and Wadhwani (1991) estimated a model of employment, based on a sample of 200 U.K. firms, where unions and firms bargain over wages. The results suggest that employment

is negatively related to the firm's own wage and the change in the own wage relative to outside opportunities. The impact of labor protection on corporate debt maturity structures was investigated by Belkhir et al. (2016) in 43 countries for the period 1990-2010. They found that in countries, in which labor force is highly protected through state's legislation, firms tend to borrow more short-term. In view of the above, we have collected all the relevant papers on this line of the literature and concisely report them in a table format and then use them in analyzing our results (Table 1).

In general, the industry of corporate bonds in U.S. and E.U. has grown strongly in recent years. The remarkable growth in debt capital markets points to a structural change in corporate financing according to Kaya and Meyer (2013). Since the availability of bank lending has been shrinking especially in the periphery of the E.U. area and due to the high impact of the recession, firms are increasingly turning to debt capital markets. Uuskula (2016) pointed out that *"very high levels of debt are considered to obstruct growth because of debt overhang and the possibility of debt deflation. In addition to the problems of excessive debt levels, levels of debt being too low might be a sign of weakness in the financial sector or poor financing conditions for firms"*. Moreover, investors are looking for higher returns, since treasury bonds are offering historically low yields. In 2016 American equity issuance amounted to just under $200bn, while the total of corporate bonds reached $1.5trn and has risen by half over the past five years. Similarly, in E.U. area, there have been €345bn of non-financial corporate bonds issued in euros in 2016 and the total amount was less than half back to 2007. Even European Central Bank (ECB) has been buying corporate bonds since 2016, and now holds more than €120bn compared to €1.8trn of government bonds. It is not buying unsecured bank bonds, but holds close to €250bn of covered bonds.

In Greece, corporate bonds issued by non-financial firms worth €7bn over the last five years in the Athens Stock Exchange or in international markets. Large corporations and banks have already tapped the international debt markets in 2013 and 2014 (Table 2). The total amount of issued corporate bonds in these years of all listed firms including banks was €7.725bn. There was a massive increase of corporate debt in the first three quarters of 2014 (€4.875bn) compared to 2013 (€2.850bn), indicating somehow, the need of firms to access funding for their development strategies. Furthermore, firms with a high reputation abroad can raise large amounts of funds by issuing global bonds instead of domestic bonds. According to Tawatnuntachai and Yaman (2008) firms also tend to issue global bonds when the domestic economy is weak. Sometimes, the balance-sheet of a corporation contains better results than the balance-sheet of a state and investors trust the numbers.

Table 1. Most Important Studies on the Effects of Several Factors on Employment

| Dependent		Independent								Study
Log of employment		Lagged employment terms	Lagged real wages	Relative raw materials price	Competitiveness	Fiscal stance	World income	D/E ratio	Nominal interest rate	Wadhwani (1987)
Volatility of firms' investment rates	Volatility of firms' employment growth rates	Firm size		Average growth rates		Sales volatility		Cash flow volatility		Cantor (1990)
Employment growth rate		[Leverage(t-2)+Size(t-2)]* Future expected sales growth(t+1)		[Leverage(t-2)+Size(t-2)]* Future expected sales growth(t)		Leverage (t-2)		Size (t-2)		Sharpe (1994)
Actual employment		Employment lagged values		Log of capital		Log of wage	Log of prices	Ratio of debt to & collateralizeable' net worth		Nickell & Nicolitsas (1999)
Employment % change		Employment % change (t-1)	Average % change in sales over the last 2 years	Leverage and lagged values	Size and lagged values	Leverage on employment elasticity		Conditioning influence of size on employment elasticity		Heisz, A. & LaRochelle-Cote (2004)
Fixed-term / Permanent contract	Employment	Fixed capital		Log standard deviation of sales		Growth assets		Small firms		Caggese & Cunat (2008)
Employment growth		Industry's share		External dependence * stock market capitalization		External dependence * claims of banks and other financial instruments				Pagano & Pica (2012)
Employment growth		Tobin's q (t-1)	Cash flow	Expansion	Industrial production	Sentiment	CSI	Interactive terms		McLean & Zhao (2014)
Natural logarithm of employees		Lagged employment (t-1)	Lagged employment (t-2)	Log of tangible fixed capital	Change in the log of the average firm wage	Lagged level of average real wage	Change in log of output	F(1), F(2) Financial vectors	Z vector (firm size, age, stock market status)	European Commission (2014)
Employed or Unemployed compared to previous year		Industry-state fixed effects (probability of switching from employment to unemployment)		X vector: controls for workers' observable differences in age, gender, ethnicity, and years of completed education		Recession periods (Dummy)	Small firm (<100 Employees)	Recession * small firm		Burcu Duygan-Bump et al. (2015)
Debt Maturity		Fraser Institute's Labor Market Regulation Index	Measure of labor protection regulation	Leverage	Size	Market-to-Book ratio	Asset tangibility ratio	Asset maturity	Inflation and others variables	Belkhir et al. (2016)
% change in establishment-level employment		Percentage change in house prices		Level of firm leverage				Interaction term		Giroud & Mueller (2017)
Log change in employment		Log change in lagged employment	Log change in output (value added)	Average wage	Log change in output (value added) * Lagged External financial constraints		Log change in output (value added) * Lagged Internal financial constraints		Other various explanatory variables	Baurle et al. (2017)

Table 2. Corporate Bonds of Listed Greek Firms Issued in Domestic and International Markets in 2013 and 2014

Corporation	Announcement Date	Maturity	Amount Issued (Eur Mil)	Coupon	Coupon Type	Coupon Frequency	Rating
2013							
Coca-Cola	Jun 2013	Jun 2020	800	2,375	Fixed	Annual	BBB
Hellenic Telecommunications Organisation	Jan 2013	Feb 2018	700	7,875	Fixed	Semi-Annual	BB-
Hellenic Petroleum	Apr 2013	May 2017	500	8,000	Fixed	Semi-Annual	--
Intralot	Aug 2013	Aug 2018	325	9,750	Fixed	Semi-Annual	B+
SB Minerals	Jul 2013	Aug 2020	275	9,250	Fixed	Semi-Annual	B+
Frigoglass	May 2014	May 2018	250	8,250	Fixed	Semi-Annual	BB-
Total Amount Issued			**2,850**				
2014							
Public Power Corporation	Apr 2014	May 2019	500	5,500	Fixed	Semi-Annual	B
Public Power Corporation	Apr 2014	May 2017	200	4,750	Fixed	Semi-Annual	B
Intralot	Apr 2014	May 2021	250	6,000	Fixed	Semi-Annual	B+
Motor Oil	May 2014	May 2019	350	5,125	Fixed	Semi-Annual	--
Titan	Jul 2014	Jul 2019	300	4,250	Fixed	Semi-Annual	BB
Hellenic Petroleum	Jun 2014	Jul 2019	325	5,250	Fixed	Semi-Annual	--
Hellenic Telecommunications Organisation	Jul 2014	Jul 2020	700	3,500	Fixed	Annual	BB-
Piraeus Bank	Mar 2014	Mar 2017	500	5,000	Fixed	Annual	CCC+
National Bank of Greece	Apr 2014	Apr 2019	750	4,375	Fixed	Annual	CCC+
Alpha Bank	Jun 2014	Jun 2017	500	3,375	Fixed	Annual	CCC+
Eurobank	Jul 2014	Jun 2018	500	4,250	Fixed	Annual	CCC+
Total Amount Issued			**4,875**				

Source: Piraeus Bank Research

However, despite their importance as a source of financing, the corporate-bond market is still archaic and often a transaction requires a phone call to a trading desk at an investment bank and the processes are very slow. Even though they offer new investment opportunities for savers, basic price data is difficult to be reached, while at the same time other financial commodities like stocks, futures or options can be traded at the click of a button. This method of trading still accounts for the majority of corporate bonds worldwide.

Figure 1. Non-Financial Corporations Reporting Difficulty in Getting Bank Loans
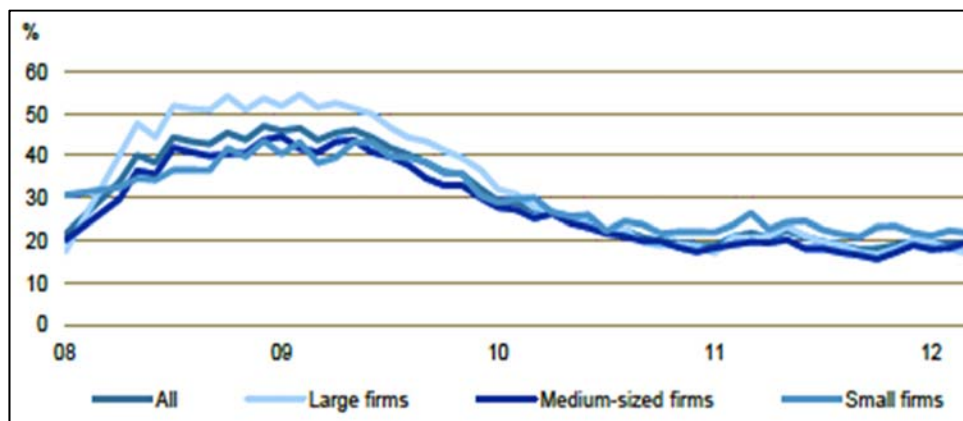
Source: Deutsche Bank

The recession in the E.U. hit hard the southern member states. According to Eurostat, that caused a sharp fall in the proportion of successful bank loan applications of firms (Figure 1 above). The lack of diversification in financing made firms to be highly depended on bank financing. Thus, credit markets play a very important role.

We must mention though that the majority of corporate bonds that are issued by private or public companies are traded over-the-counter (OTC) rather than stock exchanges. However, what we actually examine in this paper is the role of the Greek debt capital markets to drive growth that bridging the funding gap through bond markets in a period where firms need more the ever capital for their investments. Douglas (1991) examined when a debt contract will be monitored by lenders. Firms may choose either to borrow funds directly from the capital markets (issue a corporate bond or a commercial paper without monitoring), or to borrow from a financial institution that monitors to alleviate moral hazard. The results suggest that middle-rated firms rely on monitored bank loans. They will start building their reputation by being monitored and later they can issue publicly traded bonds. On the other hand, high credit rated firms have a lower cost of capital, and such a rating needs to be maintained to retain this source of higher present value of future profits. We must also note that a corporate bond is an alternative form of funding, a type of loan that is issued by the borrower (the firm) not through banking intermediation, but through the capital markets, ensuring medium-term and long-term capital, flexibility and security. Bonds allow the issuer to finance long-term investments with external funds. However, bank debt pay downs are the most frequent reason firms issue junk (high yield) bonds in order to maintain financial flexibility.

3   Data Description

The datasets which we use in order to investigate the impact of corporate bonds on employment covers the period from 2001 to 2014, which we split in one of our models in the pre-crisis period (2001-2010) and the post-crisis period (2010-2014). The reason we have chosen 2010 as the year of change is due to the fact that the Greek government signed the first memorandum (or first bailout program) with E.U. member states and International Monetary Fund (IMF), asking for €110bn financial assistance (€80bn from EU and €30bn from IMF) in order to cope with the government-debt crisis. The dataset is collected from three different sources: (i) financial firm characteristics of 294 listed Greek firms from WRDS Compustat Global, (ii) 217 issued corporate bonds (Greek financial institutions are not included) from Athens Stock Exchange and, (iii) 527 corporate bonds issued by Greek financial institutions from Bloomberg. From the last two datasets, we exclude corporate bonds issued in other currencies than EUR (e.g. USD, GBP, JPY, CHF), which do not affect the purpose of our study. Our final sample consists of 45 firms over 294 that issued one or more corporate bonds that period. The total number of corporate bonds that are issued in EUR currency are 706.

4   Methodology and Variables

We explore several models to illustrate how the need for external financing of a firm affects the link between corporate bond issuance and the firm's job creation. To examine this relation, we use the following sets of yearly-measured variables. Consistent with prior research (European Commission, 2014), we measure the dependent variable employment (EMPL) as the number of employees of the firm i at time t and we test four different models by running simple panel regressions with fixed effects. On the right-side variables, we control for firm-level variables that are known to be linked with firm growth and a new variable that controls for the amount of corporate bond. The characteristics of the independent variables are: a measure of company's size is the amount of Total Assets of the firm i at time t, a measure of leverage (LEV), which is the ratio of Long-Term Debt (LDEBT) over Total Assets (TA) of the firm i at time t; a measure of investment (INV), which is the ratio $[(TA_t + TA_{t-1}) / TA_{t-1}]$ of each firm i at time t; the Earnings Before Interest and Taxes (EBIT) of firm i at time t is an indicator of a company's profitability, calculated as revenues minus expenses excluding taxes and interest and it is watched closely by creditors, since it represents the amount of cash that a company will be able to use to pay off creditors. It shows how financial vulnerable the firms are; Capital Expenditure (CAPEX) it is an indicator of company's funds that are used to acquire, upgrade and maintain physical assets such as equipment, property, buildings, factory, technology, etc. and it is any type of expense that a company capitalizes; Pretax Earnings (PRETAX) is a company's income after all operating expenses, including interest and depreciation, have been deducted from total sales or revenues, but before income taxes have been subtracted. Because pretax earnings

exclude taxes, this measure enables the intrinsic profitability of companies to be compared across industries or geographic regions where corporate taxes differ; Corporate Bond (BOND) is the amount of the issued bond in euros in year t by firm i. Therefore, in order to understand any of the estimation results relating to the impact of corporate bonds on employment, one must be clear about the simplest econometric specification and which parameters we seek to identify in the model. As a baseline reference, we begin with the most basic dynamic model and develop it.

$$EMPL_t = f(INV, SIZE, LEV, \text{Financial Factors, BOND})_t$$

In model 1, in which all firms are included, the dependent variable is the first difference of the logarithm (dlog) of employment and the regressors are as follows: investments, which are the investments that took place the same year as the issuance of the bond; the logarithm of total assets; the logarithm of leverage; the logarithm of pretax earnings and the logarithm of corporate bond.

$$dlog(EMPL)_{i,t} = b_0 + b_1 INV_{i,t} + b_2 log(TA)_{i,t} + b_3 log(LEV)_{i,t} +$$

$$b_4 log(PRETAX\_EARN)_{i,t} + b_5 log(BOND)_t + e_{i,t} \tag{1}$$

In model 2, consistent with prior literature, we exclude from our dataset financial institutions and utilities. Fama and French (1992) state that a usual common practice in research is to exclude financial firms because the high leverage that is normal for these firms probably does not have the same meaning as for the non-financial firms, where high leverage more likely denotes financial distress. In other words, it might dominate our sample. Utilities are excluded because they operate under state regulations and rules. The dependent variable is similarly the growth of the employment and the regressors are as follows: investments; logarithm of capital expenditures; logarithm of leverage; logarithm of corporate bond.

$$dlog(EMPL)_{i,t} = b_0 + b_1 INV_i t + b_2 log(CAPEX)_{i,t} + b_3 log(LEV)_{i,t} + b_4 log(BOND)_t + e_{i,t} \tag{2}$$

We regress model 3 twice; In the first regression (model 3a), our sample contains all firms and in the second regression (model 3b), financial institutions and utilities are excluded. The dependent variable is the change rate of employment and the right-hand side variables are: the change rate of long-term debt; the change rate of total assets; the change rate of earnings before interest and taxes, to control for the fact that firms which had profits/loses in past periods, may also be likely to do so in the current period; and the logarithm of the corporate bond.

$$dlog(EMPL)_{i,t} = b_0 + b_1 dlog(LDEBT)_{i,t} + b2 dlog(TA)_{i,t} +$$

$$b_3 dlog(EBIT)_{i,t} + b_4 log(BOND)_{i,t} + e_{i,t} \qquad (3a, 3b)$$

5   Empirical Results

First of all, it is worth examining the variability of the Greek GDP to have a view of the Greek Economy (Figure 2), which declined by almost -26,6% since the 2008 high and -21,44%, since the first bailout program.

Figure 2. Greek GDP 2001-2014 (in billion EUR, constant prices)
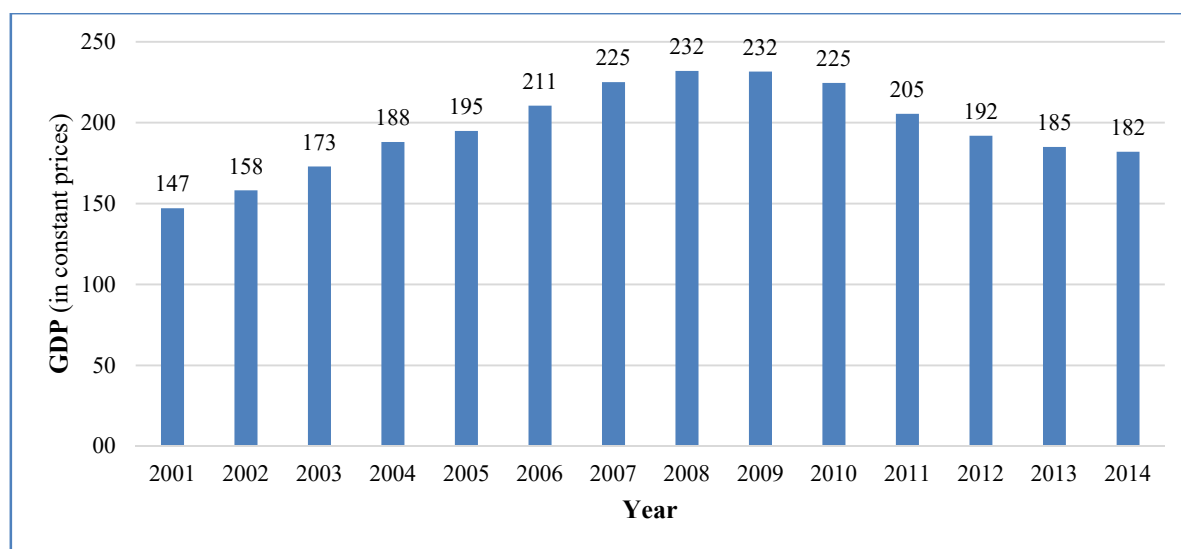
Source: Hellenic Statistical Authority (The data for has been revised with 2010 as benchmark year, according to Regulation EC 549/2013 of European Commission, ESA 2010)

According to Table 3 below, we present the estimates of the panel regression of model 1. It seems that corporate bonds have a small negative effect on employment (all period & pre-crisis). Investments have a positive effect as expected in all cases, while leverage has a positive effect in all period and pre-crisis samples and a negative effect in the recession, in line with the literature. Also, size has a negative effect (all period & pre-crisis). The larger the company, it doesn't mean that hires more employees. Pretax earnings have a positive effect (all period & pre-crisis). The values of the Durbin-Watson (DW) statistic, that tests for first-order (lag one) autocorrelation in the residuals denotes that the error terms are non-autocorrelated and our estimation is significant, while R^2 is quite satisfactory.

Table 3. Model 1 Panel Regression, All Firms

Dependent: DLog (Employment)	ALL PERIOD		PRE-CRISIS		POST-CRISIS	
Explanatory	Estimate	p-value	Estimate	p-value	Estimate	p-value
Investments	0.185	0.000***	0.173	0.001***	0.302	0.043**
Log (Total Assets)	-0.014	0.050**	-0.035	0.001***	0.004	0.544
Log (Leverage)	0.008	0.060*	0.017	0.000***	-0.040	0.002***
Log (Pretax Earnings)	0.027	0.007***	0.040	0.004***	0.004	0.644
Log (Bond)	-0.015	0.004***	-0.017	0.022**	0.003	0.571
	R^2=0.49	DW=1.90	R^2=0.81	DW=2.30	R^2=0.82	DW=2.15

Levels of significance: *** 1%, ** 5%, * 10%. The heteroscedasticity of the error terms is corrected by using White robust standard errors.

In Table 4, we exclude financial institutions and utilities as suggested in the literature. Corporate bonds have a negative effect on employment in all period and post-crisis samples. It is a valuable information for our research though that corporate bonds have negative effect on employment in the post-crisis period. Actually, this result indicates that after the issuance of the corporate bond, firms don't hire more employees to implement their projects, but rather they handle their debt obligations during the Greek economic crisis. The sign though is positive in the pre-crisis period, even though it is not significant. DW and R^2 values are quite sufficient in this case. Investments have nearly a borderline negative effect (all period and post crisis) indicating that firms didn't hire employees in the recession in order to implement their projects. Leverage has a negative effect in pre-crisis sample and positive effect in the post crisis sample. Capital expenditure has a positive effect in all periods, which seems normal.

Table 4. Model 2 Panel Regression, Financial Institutions and Utilities Excluded

Dependent: DLog (Employment)	ALL PERIOD		PRE-CRISIS		POST-CRISIS	
Explanatory	Estimate	p-value	Estimate	p-value	Estimate	p-value
Investments	0.231	0.000***	0.233	0.006***	0.095	0.000***
Log (CapEx)	-0.012	0.008***	-0.019	0.248	-0.018	0.001***
Log (Leverage)	-0.016	0.313	-0.094	0.010	0.065	0.000***
Log (Bond)	-0.001	0.748	0.022	0.182	-0.028	0.000***
	R^2=0.53	DW=2.48	R^2=0.63	DW=3.53	R^2=0.91	DW=1.92

Levels of significance: *** 1%, ** 5%, * 10%. The heteroscedasticity of the error terms is corrected by using White robust standard errors.

However, DW is high in the pre-crisis sample. Thus, there is statistical evidence that the error terms are negatively autocorrelated suggesting that there is information that has not been accounted for in the model, which can lead to underestimates of the standard error and can cause a researcher to think predictors are significant when they are not.

According to Table 5, where all firms are included, the results suggest that corporate bonds have a small negative effect on employment in all samples. Growth rate of total assets (investments) has the usual positive effect in all samples and growth rate of long-term debt has a positive effect in all period and pre-crisis samples, while it is negative in the recession which supports literature's findings. Growth rate of earnings before interest and taxes has a negative effect on employment in all samples. DW and R^2 values are adequate.

In Table 6, we ran the test again as before by excluding financial institutions and utilities.

Table 5. Model 3a Panel Regression, All Firms

Dependent: DLog (Employment)	ALL PERIOD		PRE-CRISIS		POST-CRISIS	
Explanatory	Estimate	p-value	Estimate	p-value	Estimate	p-value
DLog (Long-Term Debt)	0.015	0.002***	0.013	0.017**	-0.024	0.004***
DLog (Total Assets)	0.502	0.000***	0.431	0.002***	0.544	0.000***
DLog (Ebit)	-0.042	0.000***	-0.035	0.260	-0.031	0.003***
Log (Bond)	-0.010	0.008***	-0.013	0.026**	-0.007	0.039**
	R^2=0.74	DW=2.34	R^2=0.86	DW=2.14	R^2=0.86	DW=2.79

Levels of significance: *** 1%, ** 5%, * 10%. The heteroscedasticity of the error terms is corrected by using White robust standard errors.

Table 6. Model 3b Panel Regression, Financial Institutions and Utilities Excluded

Dependent: DLog (Employment)	ALL PERIOD		PRE-CRISIS		POST-CRISIS	
Explanatory	Estimate	p-value	Estimate	p-value	Estimate	p-value
DLog (Long-Term Debt)	0.018	0.011**	0.039	0.000***	-0.038	0.354
DLog (Total Assets)	0.723	0.000***	1.050	0.000***	0.115	0.078*
DLog (Ebit)	-0.054	0.000***	-0.255	0.001***	-0.051	0.000***
Log (Bond)	-0.012	0.023**	0.104	0.000***	-0.011	0.024**
	R^2=0.77	DW=2.71	R^2=0.99	DW=1.73	R^2=0.92	DW=2.68

Levels of significance: *** 1%, ** 5%, * 10%. The heteroscedasticity of the error terms is corrected by using White robust standard errors.

The issuance of a corporate bond has a negative effect in all period sample, but most importantly it is positive and statistically significant in the pre-crisis period and negative in the Greek economic crisis, supporting further the findings in model 2. The results indicate that firms tend to hire more employees and proceed to their investment plans before the crisis, while on the contrary they handle their debt obligations during the recession and reduce their operational costs. The growth rate of total assets (investments) is again statistically significant in all samples. Similarly, growth rate of long-term debt has nearly a positive effect in all period and pre-crisis samples. The sign though is negative in the recession but non-significant. The growth rate of earnings before interest and taxes has surprisingly a negative effect on employment in all samples, with a higher impact in the pre-crisis period. An explanation is that even if some of the Greek firms might have earnings, they try to reduce their operational costs and keep them in low levels in order to have the appropriate cash flow to survive (pay suppliers, loans, taxes etc.) in the recession or to share dividends, proceed to investments or acquisitions in the pre-crisis period, but definitely they don't use their earnings to hire more staff.

6 Robustness Analysis

6.1 Model Selection Criteria – J-Tests

We will use in our study the Akaike Information Criterion (AIC) developed by Akaike (1974) and J-tests developed by Davidson and MacKinnon (1981) in order to compare non-nested models.

AIC is an estimated measure for selecting among econometric models. It actually tests how well each model fits the dataset without over-fitting it. AIC essentially estimates the quality of each model, as they relate to one another for a certain set of data, making it an ideal method for model selection. It embodies the Residual Sum of Squares (RSS) and some penalty for the loss of degrees of freedom for adding to many variables. The AIC is given by the following formula, where K is the number of parameters and N the number of observations:

$$AIC = \left(\frac{2K}{N}\right) + ln\left(\frac{RSS}{N}\right) \tag{4}$$

Gujarati (2004) mentioned that AIC is useful for both nested and non-nested models. When we compare two or more models, the lowest value of AIC is preferred.

Regarding J-tests consider the following two competing models:

$$H_1; y = X_1 b_1 + e_1$$

$$H_2; y = X_2 b_2 + e_2$$

These models are non-nested because the regressors under one model are not a subset of the other model, even though X_1 and X_2 may share some common variables. The idea of the J-test is that if one model is the correct model, then the fitted values from the other model should not have explanatory power when re-estimating that model. In other words, if the first model contains the correct set of regressors, then including the fitted values of the second model into the set of regressors should provide no significant improvement. But if it does, it can be concluded that the first does not contain the correct set of regressors. The J-test statistic is simply the marginal test of the fitted values in the augmented model.

We must mention that it might be possible either to reject hypothesis in both cases, against the alternatives, which means that we must look for a better model for the data or it might be also possible to fail to reject both models, suggesting that the data do not provide enough information to discriminate between the two models.

Alternatively, we can artificially nest the two models:

$$H_3; y = X_1 b_1 + X_2^* b_2^* + e_3$$

Where X_2^* excludes from X_2 the common variables with X_1. A test for H_1 is simply the F-test for $H_0; b_2^* = 0$.

Therefore, in our study we perform J-tests in order to compare models 1 and 3a (all firms included) and models 2 and 3b (financial firms and utilities are excluded). In case that we cannot conclude through the tests, we will consider the AIC value (Table 7).

Comparing models 1 and 3a, the results overall suggest that model 3a is preferred. The fitted values from 1 are not significant to 3a in all three samples, while the fitted values of 3a enter significantly in 1 in all period and pre-crisis samples. In the post-crisis sample that is non-significant, the AIC shows that model 1 is preferred.

Table 7. J-Tests and Akaike criterion for non-nested models

	ALL PERIOD		PRE-CRISIS		POST-CRISIS	
	Estimate	p-value	Estimate	p-value	Estimate	p-value
Fitted 1 (to Model 3a)	-0.556	0.185	-0.724	0.140	0.004	0.985
Fitted 3a (to Model 1)	2,448	0.000***	2,985	0.000 ***	1,311	0.160
	AIC 1 = -3.985 AIC 3a = -4.442		AIC 1 = -3.891 AIC 3a = -4.141		AIC 1 = -5.192 AIC 3a = -5.140	
	ALL PERIOD		PRE-CRISIS		POST-CRISIS	
	Estimate	p-value	Estimate	p-value	Estimate	p-value
Fitted 2 (to Model 3b)	0.481	0.308	-0.427	0.000***	1,061	0.110
Fitted 3b (to Model 2)	0.723	0.000***	0.941	0.004***	-0.044	0.604
	AIC 2 = -3.755 AIC 3b = -4.221		AIC 2 = -3.449 AIC 3b = -5.578		AIC 2 = -4.410 AIC 3b = -5.036	

Levels of significance: *** 1%, ** 5%, * 10%

Comparing models 2 and 3b, the fitted values from 2 are not significant to 3b in all period and post-crisis samples. The fitted values of 3b enter significantly in 2 in all period and pre-crisis samples. It seems that according to J-tests, model 3b is preferred and AIC 3b supports the results. However, we must repeat that the literature clearly states that findings are more meaningful when financial institutions and utilities are excluded from our samples.

6.2 Addressing Heterogeneity and Endogeneity Using IV

We deal with heterogeneity and endogeneity issues through instrumental variables (IV) techniques, in order to support further our findings (Table 8).

In accordance with our previous results, corporate bonds have a negative effect on employment in the all period sample, either we use all firms or exclude financial firms and utilities from our dataset. Moreover, it is statistically significant in model 2. Investments are positive and significant again as expected, while leverage and long-term debt have a positive impact on employment, similarly with our previous findings. Therefore, we demonstrated robustness checks and reported alternative specifications to test the same hypothesis, which conclude that our main analysis is valid.

Table 8: GMM regressions

All Firms (models 1 and 3a)					
Dependent: DLog (Employment)	ALL PERIOD			ALL PERIOD	
Explanatory	Estimate	p-value	Explanatory	Estimate	p-value
Investments	0.590	0.000***	DLog (Long-Term Debt)	0.006	0.5104
Log (Total Assets)	0.013	0.000***	DLog (Total Assets)	0.765	0.0000***
Log (Leverage)	0.010	0.393	DLog (Ebit)	-0.032	0.0273**
Log (Pretax Earnings)	-0.011	0.000***	Log (Bond)	-0.019	0.0000***
Log (Bond)	-0.023	0.000***			
	R^2=0.98	DW=1.94		R^2=0.96	DW=2.39
Financial Institutions and Utilities excluded (models 2 and 3b)					
Dependent: DLog (Employment)	ALL PERIOD			ALL PERIOD	
Explanatory	Estimate	p-value	Explanatory	Estimate	p-value
Investments	0.192250	0.0000***	DLog (Long-Term Debt)	0.074	0.202
Log (CapEx)	-0.013594	0.5963	DLog (Total Assets)	0.587	0.011**
Log (Leverage)	0.079799	0.1538	DLog (Ebit)	0.139	0.049**
Log (Bond)	-0.050188	0.0145**	Log (Bond)	-0.016	0.095*
	R^2=0.89	DW=1.76		R^2=0.97	DW=2.83

Levels of significance: *** 1%, ** 5%, * 10%. The heteroscedasticity of the error terms is corrected by using White robust standard errors.

7 Conclusions

The main contribution of this paper is that it critically extends the literature on the effects of external financing on employment on how, in particular, the issuance of a corporate bond of a firm affects its employment. We focus our research in Greece, because it is the country that was hit the hardest than any other EU member state during the economic crisis. In addition, we have made a thorough literature review and have collected all major studies in the literature on the effects of different factors on employment in a concise table.

Our results indicate that in the cases where all firms are included in our models, corporate bonds have a small but negative effect on employment, while investment has a positive effect in all tested models in line with the literature. However, as suggested, it is better if we exclude from our sample financial institutions and utilities. In this case, in the recession period, it seems that Greek firms reduce their operational costs and manage to control their debt obligations, by issuing corporate bonds in order to repay or extend their loans. The effect is negative on employment in this case (model 2 and 3b). On the other hand, in the pre-crisis period (model 3b), the effect on employment is positive. Greek firms increase their labor force, which means that they proceed on their investment choices. We support our findings with robustness checks.

We must mention though that there are cases, in which Greek firms issue a bond (usually a syndicated loan[1]) to refinance existing loans and make short-term debt to long-term debt and this is not the case of an investment choice that could increase the labor force. We must have in mind that the financial position of the corporate sector may influence the performance of the real economy, the social cohesion and the stability of the financial system. Nevertheless, worth considering further is the difference among a large, medium or small firm that issues a bond. Any analysis should differ, as access to bond markets differs, since large firms can absorb fixed costs for accessing the corporate market, which is addressed mostly to medium and large healthy corporations. It should be very interesting to examine the Mid-Cap bond market and the effect on employment. Does Mid-Cap lack liquidity? Because smaller enterprises and start-ups surely do, as they are unable to access bank funding because of their high-risk and size, waiting for business angels or a funds to support their projects. Furthermore, future researchers may want to investigate and test more variables such as Tobin's q to control for growth opportunities, M&A dataset, credit ratings, bonds with longer maturity because they expected to have higher default risk, more firm's specific characteristics such as (e.g. D/E ratio, R&D spending), or even test datasets of the EU Mediterranean countries, such as P.I.G.S. (Portugal, Italy, Greece, Spain).

In conclusion, it should also be noted that the majority of corporate bonds are traded over-the-counter (OTC) rather than stock exchanges. Non-financial firms are more open of using

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[1] A corporate bond is covered by private and institutional investors of either a bank or a consortium of banks, hedge funds that work together to provide the loan and spread the risk of a borrower default, mainly to large value funds, and so-called syndicated loans.

capital-market-based financing, they are issuing high volumes of corporate debt to raise financing and often substitute bank loans by taking the advantage of the lowest bond yields in the last decade. Therefore, there is a lot of data that could be used to extend the research on the effect on employment of the corporate bond market.

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