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Regression Analysis of Macroeconomic Conditions and Capital Structures of Publicly Listed British Firms

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Abstract: Using an unbalanced panel of 922 non-financial companies publicly listed on the London Stock Exchange during January 1995 and September 2014, this article tests the predictions of Pecking Order Theory (POT), Trade-off Theory (TOT) and Market Timing Theory (MTT) of capital structure through the lens of macroeconomic conditions. We find strong evidence that leverage is negatively associated with the business cycle but positively related to stock market performance, which is consistent with POT. In addition, leverage is negatively related to financial market risk, as predicted by TOT. Furthermore, leverage is positively related to credit supply, which is in line with both the POT and TOT. Finally, there is no evidence in support of MTT. The above results are robust with respect to the measurement of macroeconomic variables, the choice of estimation methods and the inclusion of a dummy variable to account for the effect of the 2008 financial crisis. An important implication is that, because firms tend to be highly levered during business cycle downturns, expansionary fiscal and monetary policies to encourage more business borrowings may not be effective after all.

Keywords: capital structure; macroeconomic conditions; firm-specific variables; pecking order theory; trade-off theory; market timing theory

MSC: 91G50

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1. Introduction

Unveiling the determinants of capital structure is important in understanding how firms take up advantageous investment opportunities to maximise growth, e.g., firms may strategically issue debt to increase after-tax earnings by exploiting tax shields to their benefit. Hence, after the pioneering work by [1], several theories, such as 'trade-off', 'pecking order', 'agency', 'market timing', 'industry structure' and 'market microstructure', were developed to explain capital structure choices. Some empirical studies, such as [2], pointed out that transaction costs, taxes, bankruptcy, adverse selection and agency conflicts are main factors underlying the formation of capital structure through debt (Some of the material of this manuscript is from the PhD dissertation of the first author deposited at www.gala.gre.ac.uk (accessed on 22 June 2021), which has not been published previously.). However, existing empirical studies mainly focus on testing capital structure theories based on firm-specific characteristics. In this study, we examine three pre-eminent theories of capital structure, namely the static Trade-off Theory (TOT), Pecking Order Theory (POT) and Market Timing Theory (MTT), through the lens of macroeconomic factors. POT states that firms consider the effects of information asymmetry on their leverage and follow hierarchical financing decisions; see [3,4]. However, TOT considers the effect of bankruptcy and tax on leverage and describes that firms with high profitability tend to seek external financing by issuing debt to use their tax shield with the help of leverage [5]. MTT challenges previous theories of capital structure by considering the effect of market inefficiency on leverage; see [6–8]. However, to date, there is no generally accepted theory, and, regardless of the voluminous empirical research carried out on this subject, a consensus is yet to emerge. The last few decades have seen a growing body of literature examining how macroeconomic conditions can impact the capital structure. The study by [9] focused on the impact of stock return and showed an inversely proportional relation between profitability and leverage (ratio of total debts and total assets of a firm), i.e., firms prefer to use their retained earnings in financing profitable projects, which is consistent with the pecking order theory [1]. Similarly, the study reported in [9] showed that macroeconomic variables appear to be negatively correlated with leverage, particularly for unconstrained firms. The study reported in [10] presented a partial equilibrium model of firms' financing decisions to characterise both the speed and size of capital structure changes. Interestingly, due to a lower restructuring threshold, this has shown that companies modify their capital structure more often during good economic condition than in periods of recessions, as Cook and Tang confirmed in [11] by means of two dynamic partial adjustments. Unlike the above studies that focus on the US market, this article aims to study whether and to what extent `TAXGrate`, `IPGrate`, `M3Grate`, `RiskP`, `ComPaperSp` and `FTSE100Re` affect the `Lev` of UK firms. Table 1 shows key differences between the institutional characteristics of UK and US data. Differences in bankruptcy laws, the development of bond markets, tax codes and patterns of ownership may affect the role that macroeconomic variables play on the financing decision of UK and US firms. Thus, it is important to examine whether macroeconomic conditions affect capital structure under different institutional settings such as the UK.

Table 1. Comparison of UK and US data under different institutional characteristics. Bond markets duration and Index weights are based on Merrill Lynch series of indices [12].

	UK	**US**
Power of the banking sector	Market-oriented	Market-oriented
Bankruptcy laws	Receivership	Reorganisation and liquidation (chapters 11 and 7)
Bond Markets Average Duration (years)	8.5	4.5
Index Weight	0.049	0.437

The rationales for our choice of four types of macroeconomic variables are as follows: first, we use corporate taxes as a proxy for the business cycle because taxation is positively related to economic activities and consistent with long-run economic trends. Second, when making capital structure decisions, firms have to evaluate prevailing attitude towards risk in financial markets. It is important to make leverage adjustments to reduce business risk and optimise expected investment returns. Hence, we use a risk premium as a proxy for financial market risk. Third, expansionary monetary policy makes credit more accessible for financially constrained firms; thus, we may expect the money supply to affect firm leverage. Finally, if the stock market is overvalued, then firms will be inclined to issue more equities. On the other hand, if the stock market is undervalued, then firms have an incentive to repurchase outstanding equity shares. All of these actions can be related to capital structure decisions. Hence, we aim to answer the following questions to contribute to the existing literature:

- Is the effect of `TAXGrate` and `IPGrate` (industrial production) on `Lev` (capital structure) pro-cyclical or counter-cyclical?
- Do `M3Grate`, `RiskP`, `ComPaperSp` and `FTSE100Re` (credit supply, credit market risk and stock market performance) have significant effects on `Lev`?
- Is the impact of macroeconomic variables on `Lev` consistent with the prediction of POT, TOT and MTT?

The contributions of this paper are three-fold: (1) it derives several original hypotheses in Section 2, with the aim to test for the predictions of POT, TOT and MTT using a unique combination of the effect of macroeconomic variables. This is a major contribution to the field, given that very few studies in the literature have attempted to test capital structure theories by distinguishing the differential impact of changes in macroeconomic conditions; (2) because the dependent variable is truncated (the leverage ratio is force to lie in the interval [0,1]) and causes biases and inconsistency during estimation [13], this paper proposes, following the suggestions provided in [14], the use of the 'Tobit' regression model (described in Section 4.1.3) to better deal with the truncation issue; (3) because the bankruptcy laws, tax code and bond market size in the U.K. are different from those in the U.S., this paper sheds new light on the impact of macroeconomic conditions on capital structure using U.K. data, and draws a number of new and interesting policy implications based on the empirical results.

The rest of the paper proceeds as follows: Section 2 discusses capital structure theories and establishes four sets of hypotheses to account for the effect of macroeconomic variables on capital structure. Section 3 describes data, variables and sample characteristics. Section 4 presents various empirical models, as well as econometric methodologies. Section 5 demonstrates empirical findings. Section 6 summarises results, discusses policy implications and proposes future research ideas.

2. Hypotheses

In line with existing literature, we posit the significant impacts that macroeconomic conditions have on the financing decision of UK firms. It is well-known that the tax benefit of debt depends on the level of firms' liquidity [15]. Moreover, the probability of default affects the expected bankruptcy costs. These, in turn, are related to business cycle stages. According to POT, during economic expansion periods, firms have a higher level of cash flows, thus needing to pay more taxes. During these periods, governments may also increase tax rates to fight inflation. As a result, firms may use their internal funds to pay less tax as a result of reducing their level of cash flow. This leads to a lower leverage ratio (`Lev`) and clearly shows a counter-cyclical relationship between corporate taxes and leverage. However, during recessionary periods, economic growth slows and firms' cash flows contract. When financing needs to arise, firms inevitably have to seek external financing, which raises `Lev`. In the spirit of the above discussions, we propose the following first hypothesis:

$\mathbf{H1_A}$. *`Lev` is negatively associated with the business cycle under POT.*

In contrast, some studies use dynamic TOT to show the impact of the business cycle on `Lev`. For example, ref. [16] reports that the adjustment speed for capital structure can be quite different among companies due to adjustment costs, with 80% of firms surveyed declaring having target `Lev`. Moreover, ref. [10] shows that firms' adjustment threshold, and therefore the adjustment cost, is lower during expansion than recession. In line with previously mentioned pieces of work, ref. [17] states that, during recessions, the average solvency of a firm is lower than in economic prosperity. In economic prosperity, `Lev` will reduce, and stock prices, industrial production, corporate tax and GDP will increase. Firms need to adjust their capital structure upward in order to achieve their target `Lev`. Therefore, we propose the following alternative hypothesis:

$\mathbf{H1_B}$. *`Lev` is positively associated with the business cycle under TOT.*

In terms of the impact of financial constraints and credit supply fluctuations, the study by [18] reports that the asset bubble in the 1980s and the credit crunch of the late 1990s have significant impacts on corporate financing decisions. Hence, during recessions, small firms experience financial constraints. In addition, credit supply uncertainty has a significant negative impact on `Lev`. Analysing US firms for the period of 1986–2007 revealed how the credit supply positively affects debt choices and investment decisions [19]. In the spirit of these studies, we hypothesise that:

H2. *`Lev` is positively associated with credit supply under both POT and TOT.*

There are a number of reasons behind significant variations of the default risk premium over time, as well as the large influence from large economic shocks [20]. It is worth mentioning that the use of a dynamic capital structure model generates interesting scenarios for financing and defaults, such as credit contagion and the market timing of debt issuance. There are both counter-cyclical shifts in default probabilities and risk prices that arise endogenously through firms' reactions to the macroeconomic conditions. These co-movements create a large credit risk premium for companies, which helps to sort the credit spread puzzle and under-leveraged puzzle in a unified framework. Based on the above analysis, we hypothesise that:

H3$_{\mathbf{A}}$. *`Lev` is positively associated with financial market risk under POT.*

and, alternatively:

H3$_{\mathbf{B}}$. *`Lev` is negatively associated with financial market risk under TOT.*

Regarding the impact of stock market performance on `Lev`, there is clear evidence that firms with high profitability are required to pay more taxes [21] and, hence, they may issue more debt. However, it is argued that increasing `Lev` for firms with high profitability may offer tax benefits instead of risking a short-term liquidity crunch or bankruptcy costs [22]. Therefore, this leads to our fourth hypothesis:

H4$_{\mathbf{A}}$. *`Lev` is positively associated with stock market performance under TOT.*

Furthermore, according to the POT, firms may refrain from raising equity if their stock prices drop because of negative sentiments among investors. On the other hand, firms are more prone to raise more equity when their stock prices are in a bull market. It is also possible that firms do not use debt in financing but instead rely on retained earnings, despite the fact that they may prefer debt to equity financing. As a result, profitable firms may have less debt in their capital structure and, at the same time, experience higher accumulated retained earnings. Conversely, unprofitable firms may not have many choices but to issue additional debts to meet financing needs. Finally, firms may be reluctant to raise more equity if their stock prices decline, forcing them to obtain financing through more debt. Hence, we hypothesise that:

H4$_{\mathbf{B}}$. *`Lev` is negatively associated with stock market performance according to the POT and MTT.*

Table 2 presents the relationship between `Lev` and above mentioned macroeconomic variables under each of the capital structure theories. For instance, H1$_{\mathrm{A}}$ unveils a counter-cyclical relationship between the business cycle and leverage under the POT. Similar considerations can be made for other hypotheses by following the notation indicated in Table 2.

Table 2. Summary of the proposed hypotheses and corresponding impact. A '+' symbol next to the hypothesis is used to indicate the presence of a positive impact, whereas a '−' symbol highlights a negative impact. The symbol '∼' is displayed when the impact is not to be expected.

Macroeconomic Variable	TOT	POT	MTT
Business cycle	$H1_B$ (+)	$H1_A$ (−)	(∼)
Credit supply	H2 (+)	H2 (+)	(∼)
Financial market risk	$H3_B$ (−)	$H3_A$ (+)	(∼)
Stock market performance	$H4_A$ (+)	$H4_B$ (−)	$H4_B$ (−)

3. Data Descriptions

To study the effect of macroeconomic conditions on firms' capital structure, we constructed a regression model, including different combinations of variables defined in Section 3.2. For the sake of reproducibility, details on these variables are provided as follows: Section 3.1 explains the data set and presents the data collection method, while Section 3.2 outlines the dependent, independent and control variables.

3.1. Data Collection

Our sample consists of an unbalanced panel of non-financial companies publicly listed on the London Stock Exchange from January 1995 to September 2014. As stated by [2,23], financial firms have a particular capital structure and are heavily regulated. Therefore, we excluded them from our sample. The sample period is determined by the availability of macroeconomic variables and accounting ratios. Therefore, we excluded financial firms and firms with an industry classification code of ICBIC 8000. Hence, we excluded 345 firms from the financial sector and 10 firms with no industry classification code. The sample after cleaning up contains 922 firms. Our sample consists of firms from nine industries. As Figure 1 illustrates, the largest and smallest numbers of firms in the sample belong to industrial (227 firms) and telecommunication (TLC) (16 firms) industries, respectively. Furthermore, as Table 3 shows, the consumer goods with 11.65 % and telecommunications with 10.05% have the largest and smallest average firm size. Moreover, as Table 4 shows, utilities and TLC have the highest (0.3291) and lowest (0.0542) mean leverage during the period 1995–2014 for 1996 and 2010 years, respectively.

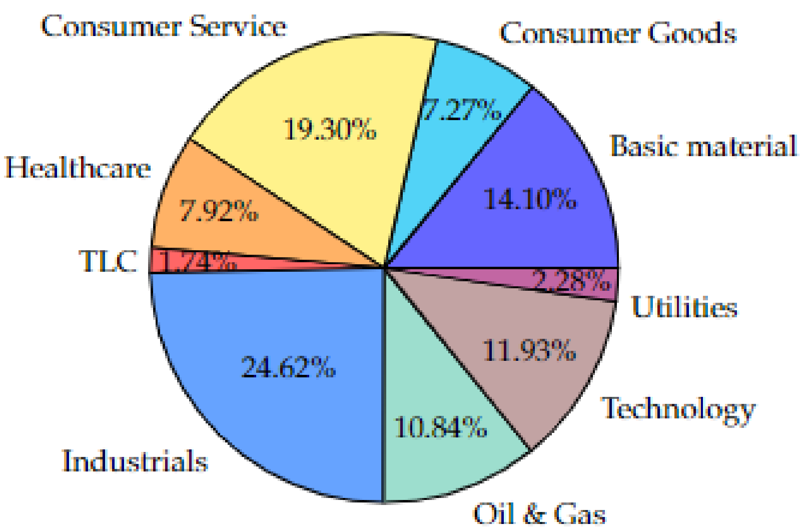

Figure 1. Non-financial British Firms Industry Classifications

Table 3. Firm-specific vs. Industry Classifications Average.

Industry Name	Oil and Gas	Basic Materials	Industrials	Consumer Goods	Healthcare	Consumer Services	TLC	Utilities	Technology
`Lev`	0.193	0.183	0.164	0.182	0.169	0.194	0.111	0.174	0.174
`Tang`	0.006	0.011	0.008	0.007	0.005	0.011	0.003	0.008	0.015
Liquidity	3.241	3.305	3.458	5.888	2.787	3.010	3.962	2.623	3.980
`Growthopp`	0.145	0.085	0.133	0.141	0.125	0.133	0.146	0.131	0.101
`Prof`	−0.257	−0.320	−0.026	−0.097	−0.088	−0.108	−0.002	−0.123	−0.210
`FSize`	11.108	11.011	11.457	11.600	10.823	11.185	10.012	11.021	11.342

Table 4. Average Leverage of UK Industries.

Year	Oil and Gas	Basic Materials	Industrials	Consumer Goods	Healthcare	Consumer Services	TLC	Utilities	Technology
1995	0.1869	0.1573	0.1591	0.1478	0.1548	0.2032	0.1951	0.2853	0.1893
1996	0.1979	0.1719	0.1598	0.1559	0.1560	0.1935	0.1050	0.3291	0.2054
1997	0.2101	0.1731	0.1497	0.1541	0.1911	0.2118	0.1101	0.2834	0.2048
1998	0.2288	0.1789	0.1637	0.1671	0.2153	0.2248	0.1736	0.2826	0.2236
1999	0.2208	0.2294	0.1809	0.1574	0.2129	0.2340	0.2673	0.2824	0.2110
2000	0.2183	0.1879	0.1777	0.1510	0.1589	0.1925	0.1496	0.2744	0.1637
2001	0.2208	0.1882	0.1739	0.1922	0.1811	0.1899	0.1852	0.1754	0.1562
2002	0.2810	0.2001	0.1845	0.2047	0.1859	0.1972	0.1882	0.1952	0.1912
2003	0.2761	0.2343	0.1534	0.2112	0.1881	0.1923	0.2223	0.1407	0.2208
2004	0.2297	0.2319	0.1665	0.2082	0.1994	0.1959	0.1350	0.1614	0.1980
2005	0.2222	0.1730	0.1642	0.1709	0.1903	0.1763	0.0911	0.1681	0.1559
2006	0.1656	0.1745	0.1637	0.1544	0.1878	0.1833	0.0813	0.1728	0.1285
2007	0.1578	0.1742	0.1637	0.1512	0.1792	0.2025	0.1098	0.1575	0.1600
2008	0.1712	0.2112	0.1844	0.1733	0.1889	0.2075	0.1007	0.1211	0.1531
2009	0.1881	0.2088	0.1829	0.2042	0.1687	0.2145	0.0875	0.1273	0.1815
2010	0.1814	0.1700	0.1571	0.1828	0.1466	0.1872	0.0542	0.1209	0.1672
2011	0.1632	0.1561	0.1468	0.1835	0.1241	0.1745	0.0778	0.1269	0.1590
2012	0.1563	0.1654	0.1530	0.1929	0.1390	0.1793	0.1041	0.1442	0.1621
2013	0.1713	0.1547	0.1569	0.1981	0.1388	0.1889	0.0862	0.1467	0.1765
2014	0.1691	0.1386	0.1471	0.2046	0.1331	0.1855	0.0828	0.1786	0.1807

The data samples for macroeconomic variables, including `RiskP`, `FTSE100Re`,`M3Grate`, `FSize`, `Growthopp`, `Tang`, `Prof` and `CRatio`, were all obtained from DataStream. Furthermore, industrial production and corporate tax data used in this article were collected from the Office for National Statistics (ONS), whereas those for the LIBOR rates were obtained from Federal Reserve Economic Data (FRED).

Our data have few new characteristics in comparison with previous works on the capital structure that have analysed UK data. To begin, we analysed a larger and more different period (from 1995 to 2014). Second, this research applies various methods, such as the Fixed Effect Model (FEM) (Section 4.1.1), the Random Effect Model (REM) (Section 4.1.2) and the Tobit regression model (Tobit) (Section 4.1.3) for data analysis. Furthermore, previous studies have not used the four above mentioned macroeconomic variables in their sample. Lastly, our sample consists of a different number of observations in comparison with the previous studies. Table 5 displays key details of previous studies in support of the aforementioned four points.

Table 5. An overview of previous studies limited to UK firms in terms of length (considered temporal period), sample size (number of considered firms) and methods (employed model).

Study	Period	Firms	Model
[24]	1959–1970	748	Logit and Probit
[25]	1977–1988	433	Variance, ANOVA
[2]	1987–1991	608	Maximum likelihood and Tobit
[26]	1983–1996	429	GMM
[27]	1984–1996	390	GMM
[28]	1973–2000	1784	GMM-system
[29]	1992–1996	87	Logit and Probit
[30]	1991–1997	1054	Fixed effects panel estimation

3.2. Variables

We consider a variety of heterogeneous variables, as described in Table 6. These include variables employed in previous relevant established studies [9], as well as other firm-specific variables that have been tested statistically.

Dependant Variable: Leverage Ratio (Lev)

This index measures the financial status of a firm as per the ratio of its total debts TD and total assets TA [2]:

$$\mathtt{Lev} = \frac{\mathtt{TD}}{\mathtt{TA}} \tag{1}$$

Negative Lev values only occur when TA < 0, a scenario that would not make sense in a real-world context, while Lev > 1 is infeasible as it can only be obtained if the total debts are higher than the value of the firm. These situations would both lead to bankruptcy. Therefore, in economics, only Lev values in the interval [0,1] are considered. Researchers in mathematical finance, management engineering and economics have tried to understand and model the relationship between the leverage and the financial health of the firm [31]. In the 1950s and 1960s, the importance of leverage was underestimated: an early study performed on an ideal economic scenario published in [1] concluded that the value of a firm did not depend on the leverage. In the 1970s, this idea was shown to be wrong when real-world economic conditions such as debt tax shields, asymmetric information, market inefficiency, transaction cost and bankruptcy law were taken into account—see [3,32]. In any case, detecting the optimal leverage value is not a trivial task since it depends on a number of factors, such as the presence of a financial crisis, the taxation system, the bankruptcy laws and development of bond markets of a country, the structure of the market, etc.—see [5,33,34] as an example. Thus, a firm's manager is often expected to react to the environmental changes and make a decision on the leverage (increase or decrease it), which has consequences on the financial health of the firm, which has to be carefully observed [35].

Table 6. Variables Definition.

Variable	Proxy	Symbol
Leverage	Book Leverage	Lev
Business Cycle	Industrial Production Growth	IPGrate
	Corporate Tax Growth Rate	TAXGrate
Financial risk premium	Risk Premium $= \mathtt{prime} - \mathtt{Treasury}^{USA}$	RiskP
	Commercial Paper Spread $= \mathtt{LIBOR} - \mathtt{Treasury}^{USA}$	ComPaperSp
Credit Supply	M3 Growth Rate $= \log \mathtt{M3} - \log \mathtt{M3}$	M3Grate
Stock Market Performance	FTSE100 Return $= \ln \mathtt{P}_t - \ln \mathtt{P}_{t-1}$	FTSE100Re
Tangibility	Tangible assets divided by total assets	Tang
Profitability	Earnings (pre-interests and taxes) over the total assets	Prof
Firm Size	logarithm of total assets: $\mathtt{FSize} = \ln(\mathrm{TA})$	FSize
Growth Opportunity	Growth rate of net sales	Growthopp
Current Ratio	Current assets divided by current liabilities	CRatio

4. Methodology

For the sake of clarity, details on the regression models are given in Section 4.1. To evaluate the effect of macroeconomic conditions on the capital structure of UK firms, we used the following static estimation strategies: the Fixed Effect Model (FEM) (Section 4.1.1), the Random Effect Model (REM) (Section 4.1.2) and the Tobit regression model (Tobit) (Section 4.1.3). Subsequently, their heteroscedasticity is checked using the Wald statistic [36], and the best model is selected via the Hausman test [37]. According to Gujarati and Porter [38], different regression analyses can use cross-sectional, time-series and panel data based on the data sample. We used panel data as our sample consists of firms as the time-invariant data and macroeconomic variables as time-varying outcome. Hence, we combined the macroeconomic, and firm-specific variables, which, thus, is better for testing their impact on a firm's capital structure than considering both times series and cross-sectional aspects of data.

Due to the Ordinary Least Square (OLS) model's inadequacy to control heterogeneity, which may be caused by characteristics that differ among firms but are invariant over time, in this study, FEM and REM were preferred. This is also evident from previous successful studies. For instance, in [39], leverage is measured by employing least squares-based methods and analysed via linear regression modelling. Differently, in [30], pooled OLS, fixed effects and random effects panel estimation models are used. Finally, the work by [38] deals with *unbalanced* panel data (i.e., each unit does not have the same number of observations).

4.1. Static Panel Data Regression Model

The initial regression of capital structure is formulated as a function of macroeconomic variables (the independent variables), firm-specific and financial crisis (the control variables). These variables were described in Section 3.2 and Table 6 above. From an analytical point of view, the regression model associated with the leverage $\texttt{Lev}_{i,t}$ for a generic company i in the year t is given by the following multivariate linear function:

$$\begin{aligned}\texttt{Lev}_{i,t} =&\alpha_{i,t} + \beta_1\texttt{BusinessCycle}_t + \beta_2\texttt{M3Grate}_t + \beta_3\texttt{Risk}_t + \beta_4\texttt{FTSE100Re}_t + \\ &+ \beta_5\texttt{Crisis}_\texttt{D} + \gamma_1\texttt{Tang}_{i,t} + \gamma_2\texttt{CRatio}_{i,t} + \gamma_3\texttt{Growthopp}_{i,t} + \gamma_4\texttt{Prof}_{i,t} + \gamma_5\texttt{FSize}_{i,t} + \epsilon_{i,t}\end{aligned} \tag{2}$$

In our case, $i \in \{1,\ldots,992\}$; $t \in \{1995,\ldots,2014\}$; γ_k $(k \in \{1,...,5\})$ were firm-specific variable coefficients and $\epsilon_{i,t}$ was the error term. For the sake of simplicity, Equation (2) can be rearranged as follows:

$$\texttt{Lev}_{i,t} = \alpha_i + \beta_k\texttt{Macro}_{k,t} + \beta_5\texttt{Crisis}_\texttt{D} + \beta_m\texttt{Macro}_{k,t} * \texttt{Crisis}_\texttt{D} + \theta_z\texttt{X}_{z,i,t} + \epsilon_{it} \tag{3}$$

where $\texttt{Macro}_{k,t}$ is a vector containing $k \in \{1,2,3,\ldots,6\}$ macroeconomic variables $(\texttt{Macro}_1,\ldots,\texttt{Macro}_k)$; $\texttt{Macro}_{k,t} * \texttt{Crisis}_\texttt{D}$ (with $*$ being the element-wise product) is a vector of M macroeconomic variable interactions with the crisis dummy variable; θ_z represents the coefficient for firm-specific variables; $\texttt{X}_{z,i,t}$ is a vector of firms' characteristics with z observation of each $(x_1,\ldots,x_z)$. This assumes that there is unobserved heterogeneity across firms captured by α_i, such as unobserved characteristics of firms that affect regressors [13].

4.1.1. Fixed Effect Model

The FEM linear regression model allowed the intercept to vary for all firms under the assumption that the slope coefficients are fixed across firms and overtime [40]—from which, the name 'fixed effects' is derived. Considering these assumptions, firm-specific effects can be modelled by rewriting Equation (3) as

$$\hat{\alpha_i} = \overline{\texttt{Lev}_{i,t}} - \left(\hat{\beta_k}\overline{\texttt{Macro}_{k,t}} + \beta_m\texttt{Macro}_{k,t} * \texttt{Crisis}_\texttt{D} + \hat{\theta_z}\bar{\texttt{X}}_{z,i,t}\right) \tag{4}$$

where $(\hat{\alpha_i})$ is the remaining variation in the leverage that cannot be defined by the explanatory variables. Note that $\hat{\alpha_i}$ has the subscript i on the intercept term to show that the intercepts of each firm may be different.

4.1.2. Random Effect Model

REM, also known as the error components model, shares some similarities with FEM in that the different intercept terms are used for each unit and that they are not time-dependent. However, REM makes the assumption that each intercept derives from a common one, referred to as α. This way, even though coefficients among the units are supposed to be constant over time periods, a random variable of mean value α can be used to model variations—this means that REM assumes differences between firms to have some influence on the firms' leverage. Hence, we can summarise the random error term ϵ with $\epsilon_i = \alpha + \mathrm{e}_i$, where e_i is an additive term used to model variations between cross-sections. This randomised approach gives REM more degrees of freedom and makes it possible to overcome the loss of the degree of significance present in FEM. In light of this, under REM assumptions, Equation (3) can be re-formulated as follows:

$$\mathtt{Lev}_{i,t} = \beta_k \mathtt{Macro}_{k,t} + \beta_5 \mathtt{Crisis}_{\mathtt{D}} + \beta_m \mathtt{Macro}_{k,t} * \mathtt{Crisis}_{\mathtt{D}} + \boldsymbol{\theta}_z \mathtt{X}_{\boldsymbol{z,i,t}} + \epsilon_i \tag{5}$$

where ϵ_i is the randomised error term, referred to as 'cross-section error', having null mean value and $\mathrm{var}(\epsilon_i) = \sigma_\alpha^2 + \sigma_e^2$.

An extra degree of complexity can be achieved by considering 'unobserved' effects of a firm i at a time t, represented through the 'combined time-series error' $\mathrm{u}_{i,t}$. These effects are also described with a random variable with null mean value and are added to Equation (5) to yield

$$\mathtt{Lev}_{i,t} = \beta_k \mathtt{Macro}_{k,t} + \beta_5 \mathtt{Crisis}_{\mathtt{D}} + \beta_6 \mathtt{I}_{\mathtt{D}} + \beta_m \mathtt{Macro}_{k,t} * \mathtt{Crisis}_{\mathtt{D}} + \boldsymbol{\theta}_z \mathtt{X}_{\boldsymbol{z,i,t}} + \omega_{i,t} \tag{6}$$

where $\omega_{i,t} = \epsilon_i + \mathrm{u}_{i,t}$.

To conclude, whereas FEM eliminates unobserved heterogeneity, REM formulates it as a random error term. Hence, one of the advantages of REM is the addition of a time-invariant variable into the model, whereas, in FEM, the intercept absorbs the time-invariant variables.

4.1.3. Tobit Model

The 'Tobit' model, introduced to econometric in [41], has several advantages that make it a suitable choice for this study. This model is more robust to biases introduced by truncating the leverage variable within $[0,1]$, and it is also capable of returning consistent and asymptotically normal estimates. To better deal with the effects introduced by the truncation process, we followed the approach in [42] and made use of Maximum Likelihood Estimation (MLE) to find the β values for our 'truncated Tobit' model, analytically described with

$$\mathtt{Lev}_i = \begin{cases} \mathtt{Lev}_i & \text{if } \mathtt{Lev}_t > \gamma \\ 0 & \text{otherwise} \end{cases} \tag{7}$$

with $\gamma = 1$ in this specific model. As commonly carried out [43,44], to make sure that $0 < \mathtt{Lev} < 1$, the model was formulated as

$$\mathtt{Lev}_{i,t} = \beta_k \mathtt{Macro}_{k,t} + \beta_5 \mathtt{Crisis}_{\mathtt{D}} + \beta_m \mathtt{Macro}_{k,t} * \mathtt{Crisis}_{\mathtt{D}} + \theta_z \mathtt{X}_{z,i,t} + \mathrm{u}_{i,t} \tag{8}$$

where $\mathtt{Lev}_{i,t} \in [0,1]$ and $\mathrm{u}_{i,t} \sim \mathcal{N}(0,\sigma^2)$ is the error term, and also truncated in $[0,1]$. The estimated β value makes it possible to understand the marginal effects of the truncated expected value $E(\mathtt{Lev}_{i,t} \mid 0 < \mathtt{Lev}_{i,t} < 1)$ [45]. The associated truncated density normal distribution for $\mathtt{Lev}_{i,t}$ variable is formulated as follows:

$$f(\mathtt{Lev}_{i,t} \mid 0 < \mathtt{Lev}_{i,t} < 1) = \frac{f(\mathtt{Lev}_{i,t})}{\varphi\left(\frac{1-\mu}{\sigma}\right) - \varphi\left(\frac{0-\mu}{\sigma}\right)} = \frac{\frac{1}{\sigma}\phi\left(\frac{\mathtt{Lev}_{i,t}-\mu}{\sigma}\right)}{\varphi(\frac{1-\mu}{\sigma}) - \varphi\left(\frac{0-\mu}{\sigma}\right)} \tag{9}$$

where ϕ shows the density and φ is the standard normal distribution. Note that truncation decreases the variance value, which is higher in the un-truncated distribution. Equation (9) is needed to calculate the expected value of the truncated leverage, as shown in the below equation:

$$E(\mathtt{Lev}_{i,t}) = (\beta_k \mathtt{Macro}_{k,t} + \beta_5 \mathtt{Crisis}_{\mathtt{D}} + \beta_m \mathtt{Macro}_{k,t} * \mathtt{Crisis}_{\mathtt{D}} + \theta_z \mathtt{X}_{z,i,t})\mathrm{F}(z) + \sigma \mathrm{f}(z) \tag{10}$$

where $\mathrm{f}(z)$ represents the unit normal density and $\mathrm{F}(z)$ is the cumulative normal distribution function (probability of being truncated). By using the product rule, the below rearrangement of Equation (10) is obtained:

$$\frac{\Delta E(\mathtt{Lev}_{i,t})}{\Delta \mathtt{Macro}_{k,i,t}} = \mathrm{F}(z)\left(\frac{\Delta E(\mathtt{Lev}_{i,t})}{\Delta \mathtt{Macro}_{k,i,t}}\right) + E(\mathtt{Lev}_{i,t})\left(\frac{\Delta \mathrm{F}(z)}{\Delta \mathtt{Macro}_{k,i,t}}\right) \tag{11}$$

5. Results and Discussion

The results obtained by applying the selected models are organised and discussed in the following subsections. For the sake of clarity, observations relative to descriptive statistics are gathered in Section 5.1, while the results from the three static estimations strategies are presented in Sections 5.2.1, 5.2.2 and 5.2.3, respectively.

5.1. Descriptive Statistics

Table 7 shows the summary statistics for the `Lev`, our macroeconomic and firm-specific variables. It can be noted that the mean value of total debt accounted for 17.78% of the book value of total assets, indicating a preference for UK firms in that period to issue equity rather than obtaining debt. This is also due to the UK corporate tax code, which does not give incentives for firms to finance with debt. The standard deviation of leverage shows the presence of firms whose capital structure consists of only debts, as well as the presence of debt-free firms. However, the leverage ratio 95% confidence interval of those firms being [17.44%, 18.13%] shows a slightly lower but similar trend to those obtained from previous studies [2,46], where mean debt ratios in UK firms were 0.21 and 0.18, respectively. In terms of the mean leverage value, our results are slightly higher than, but still consistent and in line with, those in [27], which reported a 0.16 value for British firms. Given the unbalanced nature of the data set, it is worth reporting the variations registered in the mean value over the considered temporal period. Figure 2 plots the leverage and macroeconomic variables during the mentioned period. As graphically shown in Figure 2a, the average leverage is quite consistent from 1995 to 2014, with minor changes from year to year. Note that the minimum average leverage value (in 2011) was significantly high, i.e., 15.6%, and so was the maximum value (in 1999), i.e., 20.9%, which shows that leverage is currently easier to manage, e.g., with minor annual changes, than it was in the early 1950s (where the US gave the UK a large loan).

As for the corporate tax growth rate, a 5.1% change is registered in the average rate for the period 1995–2014, which we both report in Table 7 and graphically display in Figure 2c. These show the corporate tax growth rate changes with an average rate of five percentage points during 1995 to 2014. It is also worth noting the decrease—from 0.33 to 0.22—graphically depicted in Figure 2e for the corporate tax rate. Since corporate tax is associated with profit, firms need to pay less tax during the recession. Notably, attention should be paid to the significant 0.07 drop in the last six years, i.e., 2008–2014, causing the `TAXGrate` variable to change from 0.33 to 0.29, as shown in Figure 2e. This shows that, due to the low level of cash flow during the recession, firms tend to issue debt, as POT suggests. Comparing Figure 2a,c shows that the corporate tax growth rate and leverage data follow a counter-cyclical trend from 1995 to 2014. Hence, during the financial crisis, the government may support corporate tax growth rate by imposing policies related to the sustainable GDP growth rate.

Table 7. Summary Statistics.

Variable	Mean	Median	Std	Min	Max	Conf. Int. (95%)	N
Lev	0.1778	0.1151	0.2072	0	0.9505	[0.1744, 0.1813]	13,765
TAXGrate	0.0514	0.0447	0.1375	−0.2904	0.2674	[0.0494, 0.0533]	20
IPGrate	−0.00000409	0.0027	0.0303	−0.0906	0.0756	[−0.0004, 0.0004]	20
M3Grate	0.0735	0.0842	0.0503	−0.0259	0.1624	[0.0728, 0.0743]	20
RiskP	0.159	0.14	0.1421	−0.05	0.41	[0.1570, 0.1610]	20
ComPaperSp	0.2677	0.2449	0.1888	0.0629	0.8933	[0.2650, 0.2703]	20
FTSE100Re	0.0007	0.0945	0.2464	−0.7878	0.2213	[−0.0028, 0.0041]	20
Tang	0.0093	0	0.0545	−0.0034	1	[0.0084, 0.0103]	13,195
CRatio	3.5	1.472	23.4324	0	2273.13	[3.0807, 3.9193]	12,000
Growthopp	0.1235	0.0741	0.8365	−11.0191	11.6272	[0.1085, 0.1386]	11,900
Prof	−0.1413	0.052	4.1144	−396.4	5.3351	[−0.2108, −0.0718]	13,463
Size	11.2109	11.0116	2.7172	0.6931	24.5519	[11.1655, 11.2563]	13,778

The minimum industrial production growth rate value, i.e., −0.090, occurs during the financial crisis, i.e., 2009, whereas the maximum value occurred years before in 1995. A three-percentage-point variation can also be observed during the whole studied period. Hence, during the financial crisis, the government should be cautious of the inflation rate and its negative effect on industrial production. Moreover, whereas a decreasing trend is shown for the pre-crisis—see Figure 2g—an increasing trend is depicted for the post-crisis, respectively. Hence, firms tend to seek internal financing and have a lower leverage ratio, as the pecking order theory indicates. Comparing Figure 2a and Figure 2g shows that the industrial production growth rate and leverage data follow a counter-cyclical trend from 1995 to 2014. Similar trends are shown for both the proxies (IPGrateand TAXGrate) of the business cycle, as shown in Figure 2c,g. Therefore, companies should be cautious of the macroeconomic condition and should effectively analyse the cost of debt in making their financing decision.

We use the M3 growth rate (M3Grate) as a key proxy of the monetary policy. Figure 2b shows a decreasing trend in M3Grate’s mean value over 1995 to 2014, but also a sharper downward trend for the post-crisis period (i.e., 2008–2014) compared with the pre-crisis period (i.e., 1995–2008). This suggests that the M3 growth rate (M3Grate) tends to decline around and after the financial recession periods, in line with business cycle proxies (IPGrateand TAXGrate). As a result, the contractionary monetary policy decreases market liquidity and discourages firms from using debt. Regarding the risk premium (RiskP), the descriptive statistics of Table 7 show that the yearly value is an average of 14.2% away from the total mean value. Unlike previous observations, Figure 2d reports a decreasing trend over 1995–2014, and also for the pre-crisis and the post-crisis when considered individually. In addition, the commercial paper spread shows a consistent decreasing trend across the three considered periods (i.e., pre-crisis, post-crisis and total period), as shown in Figure 2f. Interestingly, Figure 2b,d,f show that the commercial paper spread, risk premium and M3 growth rate are high in 2008 (the crisis year) compared with other times, which highlights that macroeconomic conditions are highly sensitive to the financial crisis. Hence, the government should mitigate the impact of the financial crisis by establishing and implementing timely monetary and fiscal policies to support firms during the financial crisis. With reference to the FTSE100 return, Figure 2h shows that its highest yearly average value, i.e., 0.22, is registered in 1998, whereas its lowest value, i.e., −0.37, in 2009. This implies an increasing trend over 1995–2014, the pre-crisis period and the post-crisis period.

In summary, the corporate tax growth rate, industrial production, risk premium and commercial paper spread show a decreasing pattern for the period before the crisis, which suggests that macroeconomic conditions have a significant impact during the financial crisis and that firms’ capital structure is highly sensitive to the macroeconomic conditions. Therefore, it is essential that the government mitigate the impact of the financial crisis by deploying and implementing timely policies, such as mitigating the corporate tax rate.

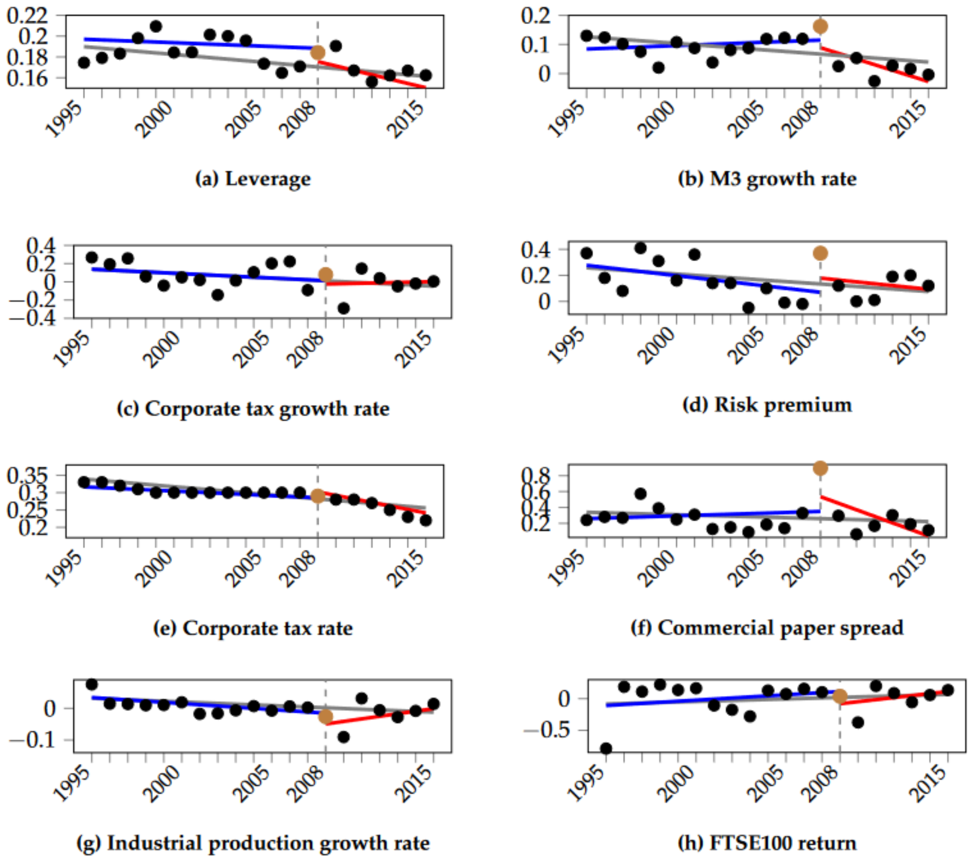

Figure 2. Leverage (**a**), Macroeconomic variables (**b**–**h**) evolution over time. Fitted lines for pre-crisis period data (in blue), post-crisis period data (in red) and the totality of data (in gray) are reported for comparison, data points for 2008 (in brown).

5.2. Empirical Results from Static Model

This section reports FEM, REM and Tobit results obtained through six different model specifications and four proxies (`IPGrate`, `TAXGrate`, `ComPaperSp`, `RiskP`). Results for model specifications 1 and 2, which do not take into consideration the effects of the financial crisis, are displayed in Tables 8a,b and 9a,b, whereas those for model specification 3 to 6, which do consider the effect of the 2008 crisis, are in Tables 10–13. We report the *t*-statistics in brackets, while *, ** and *** denote statistically significant coefficients (boldfaced) at 10%, 5% and 1% levels, respectively.

5.2.1. The Empirical Results from FEM

FEM results across all tables show consistency and are robust regardless of the choice of the proxy. Relevant implications are summarised below:

- `IPGrate` and `TAXGrate` are statistically significant and negative, thus showing a deleterious effect on non-financial firms in the UK (this supports $H1_A$ and is consistent with the prediction of POT);
- `M3Grate` has a significantly positive effect on `Lev` on the non-financial firm in the UK (this agrees with H2 and with the prediction of the POT and TOT);
- The negative coefficients for `ComPaperSp` and `RiskP` imply that financial market risk has a negative effect on `Lev` for the period after the crisis;
- `FTSE100Re` has a highly positive effect on `Lev`, which indicates that a high stock market performance leads firms to issue more debt (in line with $H4_A$ and with the prediction of TOT).

To sum up: (1) the most significant determinant of leverage for the period before and after the crisis are the credit supply, stock market performance and business cycle; (2) FEM results are highly robust to different proxies; and (3) both POT and TOT appear to have high explanatory power.

5.2.2. The Empirical Results from REM

From the REM results, the following can be concluded:

- There is a negative effect of the business cycle on `Lev`, which is in line with POT ($H1_A$);
- There is a positive effect of credit supply on `Lev`, which is in line with both POT and TOT (H2);
- There is a negative effect of financial market risk on `Lev`, which is in line with TOT ($H3_B$);
- There is a positive effect of stock market performance on `Lev`, which is in line with TOT ($H4_A$);
- Our results are highly robust, as they are not sensitive using REM models.

Hence, (1) the results illustrate that, if we do not study the impact of the financial crisis, then the business cycle, credit supply and stock market performance are the most significant determinants of capital structure in the period 1995–2014, as well as in the pre-crisis and post-crisis periods; (2) the analyses are consistent with using different variables for macroeconomic variables; and (3) both POT and TOT have explanatory power regarding the impact of macroeconomic conditions on `Lev`.

5.2.3. The Empirical Results from Tobit Model

The results obtained with Tobit show that:

- Capital structure is negatively associated with the business cycle, and this is in line with POT's prediction ($H1_A$);
- Capital structure is positively associated with credit supply, and this is in line with the prediction of both TOT and POT theories (H2);
- For the period after the crisis, capital structure is negatively associated with financial market risks, and this is in line with TOT's predictions ($H3_B$);
- The positive impact of stock market performance on capital structure is in line with TOT's prediction ($H4_A$);
- The results are in line with those obtained with FEM and REM, and hence they are robust.

In summary, (1) the results reveal that, if we do not consider the impact of the financial crisis, the credit supply, business cycle, and stock market performance are the most significant determinants of capital structure in 1995–2014, as well as for the pre-crisis and post-crisis periods; (2) in particular, the financial market risk showed explanatory power solely for the period after the crisis; (3) the analyses are consistent with using different variables; and (4) both POT and TOT have explanatory power in evaluating the impact of macroeconomic conditions on the capital structure of firms.

A final summary of the obtained results is given in Table 14 for the analysis without considering the impact of the financial crisis, and Table 15 for the case that considers the effect of the financial crisis.

Table 8. The estimation results for models 1 and 2—with `ComPaperSp` and `TAXGrate` (**a**) or `IPGrate` (**b**). T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

(a) Corporate Tax Growth Rate

Variables	**FEM**		**REM**		**Tobit**	
	1	**2**	**1**	**2**	**1**	**2**
`ComPaperSp`	−0.0078	−0.00849	−0.0115	−0.0108	−0.00749	−0.00636
	(−0.95)	(−1.03)	(−1.39)	(−1.31)	(−1.48)	(−1.25)
`TAXGrate`	**−0.162** ***	**−0.157** ***	**−0.0791** ***	**−0.0811** ***	**−0.0436** ***	**−0.0481** ***
	(−5.61)	(−5.20)	(−5.79)	(−5.90)	(−5.23)	(−5.68)
`M3Grate`	**0.165** ***	**0.186** ***	**0.206** ***	**0.189** ***	**0.142** ***	**0.108** ***
	(−4.49)	(−4.76)	(−5.65)	(−4.83)	(−6.27)	(−4.5)
`FTSE100Re`	**0.0199** ***	**0.0176** **	**0.0144** *	**0.0164** **	0.00734	**0.0113** **
	(−2.65)	(−2.29)	(−1.91)	(−2.13)	(−1.62)	(−2.44)
`Tang`	−0.0508	−0.0507	−0.02	−0.0198	−0.0221	−0.022
	(−0.88)	(−0.88)	(−0.35)	(−0.35)	(−0.64)	(−0.64)
`CRatio`	**−0.008** ***	**−0.008** ***	**−0.0084** ***	**−0.0084** ***	**−0.0114** ***	**−0.0115** ***
	(−18.14)	(−18.07)	(−19.42)	(−19.44)	(−22.77)	(−22.85)
`Growthopp`	−0.00114	−0.000919	−0.00177	−0.0019	−0.000599	−0.000892
	(−0.68)	(−0.54)	(−1.05)	(−1.13)	(−0.57)	(−0.84)
`Prof`	**−0.0013** ***	**−0.0013** ***	**−0.0018** ***	**−0.0018** ***	**−0.0009** ***	**−0.0009** ***
	(−4.12)	(−4.08)	(−5.42)	(−5.43)	(−4.94)	(−4.99)
`FSize`	**−0.0155** ***	**−0.0170** ***	**−0.00368** **	**−0.00299** *	−0.000011	0.00144
	(−8.11)	(−7.97)	(−2.49)	(−1.92)	(−0.01)	(−1.42)
`Year`		yes		yes		yes
Adjusted R2	0.09%	0.02%	3.68%	4.05%	0.0547	0.0592
Wald chi2					0.000	0.000
N	9952	9952	9952	9952	9951	9951

(b) Industrial Production Growth Rate

Variables	**FEM**		**REM**		**Tobit**	
	1	**2**	**1**	**2**	**1**	**2**
`ComPaperSp`	−0.0085	−0.00838	−0.0107	−0.0109	−0.00566	−0.00616
	(−1.02)	(−1.00)	(−1.28)	(−1.30)	(−1.11)	(−1.19)
`IPGrate`	**−0.332** ***	**−0.321** ***	**−0.285** ***	**−0.317** ***	**−0.137** ***	**−0.185** ***
	(−5.89)	(−5.50)	(−5.06)	(−5.42)	(−4.01)	(−5.16)
`M3Grate`	**0.0940** **	**0.104** **	**0.137** ***	**0.109** ***	**0.0991** ***	**0.0602** ***
	(2.96)	(3.02)	(−4.36)	(3.17)	(−5.11)	(2.85)
`FTSE100Re`	**0.0171** *	**0.0156** *	0.0103	**0.0147** *	0.00397	**0.0100** **
	(2.31)	(2.03)	(−1.4)	(1.9)	(−0.9)	(2.16)
`Tang`	−0.0538	−0.0537	−0.0227	−0.0222	−0.0239	−0.0238
	(−0.93)	(−0.93)	(−0.40)	(−0.39)	(−0.70)	(−0.69)
`CRatio`	**−0.008** ***	**−0.008** ***	**−0.008** ***	**−0.0084** ***	**−0.0114** ***	**−0.0115** ***
	(−18.06)	(−18.02)	(−19.35)	(−19.38)	(−22.73)	(−22.82)
`Growthopp`	−0.001	−0.0009	−0.0017	−0.0018	−0.0005	−0.0008
	(−0.60)	(−0.55)	(−1.02)	(−1.12)	(−0.55)	(−0.81)
`Prof`	**−0.0014** ***	**−0.0014** ***	**−0.0018** ***	**−0.0018** ***	**−0.0009** ***	**−0.001** ***
	(−4.16)	(−4.14)	(−5.47)	(−5.50)	(−4.98)	(−5.04)
`FSize`	**−0.0161** ***	**−0.0168** ***	**−0.0039** ***	**−0.00281** *	−0.0001	0.0015
	(−8.37)	(−7.86)	(−2.65)	(−1.81)	(−0.12)	(1.49)
`Year`		yes		yes		yes
Adjusted R2	0.05%	0.03%	3.52%	4.13%		
Wald chi2					0.000	0.000
N	9952	9952	9952	9952	9951	9951

Table 9. The estimation results for models 1 and 2—with `RiskP` and `TAXGrate` (**a**)/`IPGrate` (**b**). T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

(a) Corporate Tax Growth Rate

Variables	FEM 1	FEM 2	REM 1	REM 2	Tobit 1	Tobit 2
RiskP	−0.00829	−0.0054	−0.00454	−0.00756	0.00322	−0.00254
	(−0.78)	(−0.50)	(−0.42)	(−0.69)	(−0.49)	(−0.38)
TAXGrate	**−0.0809** ***	**−0.0781** ***	**−0.0717** ***	**−0.0749** ***	**−0.0383** ***	**−0.0442** ***
	(−6.47)	(−6.17)	(−5.74)	(−5.90)	(−5.02)	(−5.66)
M3Grate	**0.149** ***	**0.164** ***	**0.179** ***	**0.162** ***	**0.121** ***	**0.0921** ***
	(4.93)	(5.11)	(−5.95)	(5.02)	(−6.47)	(4.62)
FTSE100Re	**0.0177** **	**0.0159** **	0.0122	**0.0142** *	0.0069	**0.0103** **
	(2.31)	(2.05)	(−1.59)	(1.82)	(−1.5)	(2.19)
Tang	−0.0512	−0.0511	−0.0206	−0.0203	−0.0224	−0.0223
	(−0.89)	(−0.89)	(−0.36)	(−0.36)	(−0.65)	(−0.65)
CRatio	**−0.0080** ***	**−0.008** ***	**−0.0084** ***	**−0.0084** ***	**−0.0114** ***	**−0.0115** ***
	(−18.12)	(−18.05)	(−19.39)	(−19.42)	(−22.75)	(−22.84)
Growthopp	−0.0011	−0.0009	−0.0017	−0.0019	−0.0005	−0.0008
	(−0.67)	(−0.55)	(−1.04)	(−1.13)	(−0.57)	(−0.84)
Prof	**−0.0013** ***	**−0.0013** ***	**−0.0018** ***	**−0.0018** ***	**−0.0009** ***	**−0.0009** ***
	(−4.11)	(−4.07)	(−5.40)	(−5.43)	(−4.91)	(−4.97)
FSize	**−0.0157** ***	**−0.0170** ***	**−0.0038** ***	**−0.00302** *	−0.00007	0.0014
	(−8.24)	(−8.00)	(−2.60)	(−1.94)	(−0.08)	(1.38)
Year		yes		yes		yes
Adjusted R2	0.08%	0.02%	3.60%	4.03%		
Wald chi2					0.000	0.000
N	9952	9952	9952	9952	9951	9951

(b) Industrial Production Growth Rate

Variables	FEM 1	FEM 2	REM 1	REM 2	Tobit 1	Tobit 2
RiskP	−0.0079	−0.0065	−0.00376	−0.0086	0.00407	−0.00289
	(−0.74)	(−0.60)	(−0.35)	(−0.79)	(−0.63)	(−0.43)
IPGrate	**−0.310** ***	**−0.300** ***	**−0.254** ***	**−0.290** ***	**−0.119** ***	**−0.169** ***
	(−6.10)	(−5.64)	(−5.02)	(−5.43)	(−3.87)	(−5.15)
M3Grate	**0.0798** **	**0.0878** **	**0.117** ***	**0.0884** ***	**0.0857** ***	**0.0482** ***
	(2.96)	(2.95)	(−4.37)	(2.96)	(−5.18)	(2.62)
FTSE100Re	0.0148	0.0137	0.00839	0.0122	0.00397	0.0088 *
	(−1.96)	(1.78)	(−1.11)	(1.58)	(−0.88)	(1.91)
Tang	−0.0541	−0.054	−0.023	−0.0226	−0.024	−0.024
	(−0.94)	(−0.94)	(−0.41)	(−0.40)	(−0.70)	(−0.69)
CRatio	**−0.008** ***	**−0.008** ***	**−0.0084** ***	**−0.0084** ***	**−0.0114** ***	**−0.0115** ***
	(−18.03)	(−18.00)	(−19.33)	(−19.36)	(−22.71)	(−22.81)
Growthopp	−0.00101	−0.00093	−0.00172	−0.00191	−0.000595	−0.0008
	(−0.60)	(−0.55)	(−1.02)	(−1.13)	(−0.57)	(−0.82)
Prof	**−0.0014** ***	**−0.0014** ***	**−0.0018** ***	**−0.0018** ***	**−0.0009** ***	**−0.001** ***
	(−4.15)	(−4.13)	(−5.45)	(−5.49)	(−4.95)	(−5.03)
FSize	**−0.0162** ***	**−0.0168** ***	**−0.004** ***	**−0.00285** *	−0.0001	0.00147
	(−8.46)	(−7.90)	(−2.72)	(−1.84)	(−0.14)	(1.45)
Year		yes		yes		yes
Adjusted R	0.04%	0.02%	3.47%	4.1%		
Wald chi2					0.000	0.000
N	9952	9952	9952	9952	9951	9951

Table 10. The estimation results for models 3–6 (including ComPaperSp and TAXGrate). T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

Variables	FEM				REM				Tobit			
	3	4	5	6	3	4	5	6	3	4	5	6
ComPaperSp	−0.00599	−0.00635	−0.00596	−0.00177	−0.0072	−0.0053	−0.0046	0.00007	−0.0036	−0.0017	−0.0011	0.0017
	(−0.72)	(−0.72)	(−0.67)	(−0.19)	(−0.88)	(−0.60)	(−0.52)	(−0.01)	(−0.70)	(−0.32)	(−0.21)	(0.31)
TAXGrate	**−0.167*** **	**−0.163** ***	**−0.203** ***	**−0.193** ***	**−0.0726** ***	**−0.0696** ***	**−0.0540** ***	**−0.0499** ***	**−0.0373** ***	**−0.0345** ***	**−0.0193** *	−0.0169
	(−5.76)	(−5.52)	(−6.33)	(−5.03)	(−5.29)	(−4.82)	(−2.99)	(−2.75)	(−4.42)	(−3.89)	(−1.74)	(−1.51)
M3Grate	**0.0925** *	0.0973	0.0798	0.0611	0.0533	0.0279	−0.00347	−0.0241	−0.00541	−0.0293	−0.0598	**−0.0720** *
	(1.78)	(1.48)	(1.15)	(0.87)	(1.03)	(0.43)	(−0.05)	(−0.35)	(−0.17)	(−0.74)	(−1.43)	(−1.71)
FTSE100Re	**0.0184** **	**0.0184** **	**0.0210** **	**0.0193** **	0.0119	0.0115	**0.0164** **	**0.0147** *	0.0047	0.0044	**0.0091** *	0.0079
	(2.43)	(2.43)	(2.54)	(2.29)	(1.58)	(1.52)	(1.98)	(1.74)	(1.05)	(0.97)	(1.82)	(1.56)
Tang	−0.0493	−0.0493	−0.0502	−0.0486	−0.0166	−0.0162	−0.0178	−0.0161	−0.0192	−0.019	−0.0207	−0.0196
	(−0.86)	(−0.86)	(−0.87)	(−0.84)	(−0.29)	(−0.28)	(−0.31)	(−0.28)	(−0.56)	(−0.55)	(−0.60)	(−0.57)
CRatio	**−0.0081** ***	**−0.0081** ***	**−0.0081** ***	**−0.0081** ***	**−0.0084** ***	**−0.0085** ***	**−0.0084** ***	**−0.0084** ***	**−0.0116** ***	**−0.0116** ***	**−0.0116** ***	**−0.0116** ***
	(−18.23)	(−18.23)	(−18.22)	(−18.22)	(−19.56)	(−19.56)	(−19.55)	(−19.53)	(−22.96)	(−22.96)	(−22.97)	(−22.96)
Growthopp	−0.00142	−0.00142	−0.00142	−0.00141	−0.00222	−0.0022	−0.0022	−0.0021	−0.001	−0.001	−0.001	−0.001
	(−0.84)	(−0.84)	(−0.84)	(−0.84)	(−1.32)	(−1.31)	(−1.30)	(−1.30)	(−1.02)	(−1.01)	(−0.99)	(−0.99)
Prof	**−0.0014** ***	**−0.0014** ***	**−0.0014** ***	**−0.0014** ***	**−0.0018** ***	**−0.0018** ***	**−0.0018** ***	**−0.0018** ***	**−0.0009** ***	**−0.0009** ***	**−0.0009** ***	**−0.0009** ***
	(−4.14)	(−4.14)	(−4.15)	(−4.15)	(−5.40)	(−5.41)	(−5.42)	(−5.42)	(−4.94)	(−4.93)	(−4.94)	(−4.94)
FSize	**−0.0140** ***	**−0.0140** ***	**−0.0138** ***	**−0.0137** ***	−0.0019	−0.0017	−0.0015	−0.0015	**0.0018** *	**0.0019** *	**0.0021** **	**0.0021** **
	(−6.81)	(−6.75)	(−6.62)	(−6.55)	(−1.28)	(−1.14)	(−1.02)	(−0.97)	(1.86)	(1.96)	(2.15)	(2.17)
Crisis$_D$	**−0.0100** **	−0.00947	−0.0111	0.00177	**−0.0204** ***	**−0.0233** ***	**−0.0261** ***	−0.01	**−0.0200** ***	**−0.0227** ***	**−0.0254** ***	**−0.0165** **
	(−1.96)	(−1.38)	(−1.54)	(0.15)	(−4.15)	(−3.53)	(−3.79)	(−0.83)	(−6.51)	(−5.57)	(−5.97)	(−2.19)
M3Grate ∗ Crisis$_D$		−0.0126	0.0082	0.0306		0.067	0.105	0.118		0.0665	0.103	0.119
		(−0.12)	(0.08)	(0.25)		(0.64)	(0.97)	(0.98)		(1.02)	(1.52)	(1.59)
TAXGrate ∗ Crisis$_D$			−0.0193	−0.0679			−0.0362	−0.075			**−0.0357** **	−0.0722
			(−0.77)	(−0.84)			(−1.44)	(−0.92)			(−2.29)	(−1.43)
FTSE100Re ∗ Crisis$_D$				0.00445				−0.00846				0.00504
				(0.07)				(−0.13)				(0.13)
ComPaperSp ∗ Crisis$_D$				**−0.0814** *				**−0.0961** **				**−0.0571** *
				(−1.75)				(−2.06)				(−1.95)
Adjusted R2	0.22%	0.22%	0.24%	0.26%	4.63%	4.74%	4.84%	4.91%				
Wald chi2									0.000	0.000	0.000	0.000
N	9952	9952	9952	9952	9952	9952	9952	9952	9951	9951	9951	9951

Table 11. The estimation results for models 3–6 (including `ComPaperSp` and `IPGrate`). T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

Variables	FEM				REM				Tobit			
	3	**4**	**5**	**6**	**3**	**4**	**5**	**6**	**3**	**4**	**5**	**6**
ComPaperSp	−0.0081	−0.0053	−0.0093	−0.006	−0.00977	−0.00588	−0.0087	−0.00489	−0.005	−0.0026	−0.0032	−0.0009
	(−0.97)	(−0.62)	(−1.07)	(−0.68)	(−1.17)	(−0.68)	(−0.99)	(−0.55)	(−0.99)	(−0.50)	(−0.60)	(−0.18)
IPGrate	**−0.351** ***	**−0.345** ***	**−0.599** ***	**−0.581** ***	**−0.322** ***	**−0.315** ***	**−0.492** ***	**−0.472** ***	**−0.170** ***	**−0.165** ***	**−0.204** ***	**−0.193** ***
	(−6.20)	(−6.08)	(−5.89)	(−5.69)	(−5.69)	(−5.54)	(−4.87)	(−4.66)	(−4.90)	(−4.74)	(−3.34)	(−3.14)
M3Grate	−0.0171	−0.0573	−0.0424	−0.0531	−0.0426	**−0.0983** *	−0.0896	**−0.101** *	**−0.0550** **	**−0.0902** ***	**−0.0882** ***	**−0.0949** ***
	(−0.37)	(−1.05)	(−0.77)	(−0.96)	(−0.93)	(−1.80)	(−1.64)	(−1.85)	(−1.97)	(−2.72)	(−2.65)	(−2.84)
FTSE100Re	**0.0170** *	**0.0174** *	0.00466	0.00568	0.0113	0.012	0.00276	0.0038	0.0045	0.0049	0.0028	0.0035
	(2.3)	(2.36)	(0.55)	(0.67)	(1.53)	(1.62)	(0.32)	(0.45)	(1.01)	(1.1)	(0.55)	(0.68)
Tang	−0.0507	−0.0502	−0.0448	−0.0427	−0.0176	−0.0166	−0.0128	−0.0106	−0.0198	−0.0192	−0.0184	−0.0169
	(−0.88)	(−0.87)	(−0.78)	(−0.74)	(−0.31)	(−0.29)	(−0.23)	(−0.19)	(−0.57)	(−0.56)	(−0.53)	(−0.49)
CRatio	**−0.0081** ***	**−0.0081** ***	**−0.0081** ***	**−0.0081** ***	**−0.0084** ***	**-0.0084** ***	**−0.0085** ***	**−0.0085** ***	**−0.0116** ***	**−0.0116** ***	**−0.0116** ***	**−0.0116** ***
	(−18.22)	(−18.23)	(−18.28)	(−18.28)	(−19.55)	(−19.55)	(−19.60)	(−19.60)	(−22.95)	(−22.95)	(−22.95)	(−22.96)
Growthopp	−0.0014	−0.0013	−0.0011	−0.0011	−0.0021	−0.0021	−0.002	−0.0019	−0.001	−0.0009	−0.0009	−0.0009
	(−0.83)	(−0.81)	(−0.70)	(−0.68)	(−1.29)	(−1.25)	(−1.19)	(−1.17)	(−0.96)	(−0.91)	(−0.89)	(−0.87)
Prof	**−0.0014** ***	**−0.0014** ***	**−0.0014** ***	**−0.0014** ***	**−0.0018** ***	**−0.0018** ***	**−0.0018** ***	**−0.0018** ***	**−0.0009** ***	**−0.0009** ***	**−0.0009** ***	**−0.0009** ***
	(−4.20)	(−4.19)	(−4.15)	(−4.14)	(−5.45)	(−5.44)	(−5.43)	(−5.43)	(−4.97)	(−4.95)	(−4.95)	(−4.94)
FSize	**−0.0136** ***	**−0.0133** ***	**−0.0143** ***	**−0.0142** ***	−0.0018	−0.0014	−0.0017	−0.0017	**0.0019** *	**0.002** **	**0.0019** **	**0.002** **
	(−6.66)	(−6.47)	(−6.87)	(−6.80)	(−1.18)	(−0.96)	(−1.17)	(−1.12)	(1.93)	(2.09)	(1.98)	(2.02)
Crisis$_D$	**−0.0172** ***	**−0.0226** ***	**−0.0191** **	0.0149	**−0.0268** ***	**−0.0343** ***	**−0.0323** ***	0.005	**−0.0234** ***	**−0.0282** ***	**−0.0277** ***	−0.0042
	(−3.38)	(−3.47)	(−2.89)	(0.97)	(−5.44)	(−5.41)	(−5.04)	(−0.33)	(−7.59)	(−7.17)	(−6.97)	(−0.44)
M3Grate ∗ Crisis$_D$		0.133	0.108	−0.0863		**0.186** *	**0.171** *	−0.0344		**0.123** **	**0.120** *	−0.0125
		(1.33)	(1.07)	(−0.54)		(1.86)	(1.7)	(−0.21)		(1.98)	(1.92)	(−0.12)
IPGrate ∗ Crisis$_D$			**0.378** **	1.648			**0.266** **	**1.595** *			0.0595	0.925
			(3.00)	(1.76)			(2.12)	(1.7)			(0.78)	(1.58)
FTSE100Re ∗ Crisis$_D$				−0.29				**−0.307** *				**−0.198** *
				(−1.60)				(−1.69)				(−1.75)
Commercial paper spread*Crisis				−0.0567				−0.0674				−0.0397
				(−1.02)				(−1.21)				(−1.14)
Adjusted R2	0.27%	0.31%	0.21%	0.23%	4.74%	4.91%	4.77%	4.85%				
Wald chi2									0.000	0.000	0.000	0.000
N	9952	9952	9952	9952	9952	9952	9952	9952	9951	9951	9951	9951

Table 12. The estimation results for models 3–6 (including `RiskP` and `TAXGrate`). T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

Variables	FEM				REM				Tobit			
	3	4	5	6	3	4	5	6	3	4	5	6
`RiskP`	−0.0097	−0.0097	−0.0093	−0.0067	−0.008	−0.0078	−0.0072	−0.0029	−0.0004	−0.0003	0.0002	0.0028
	(−0.91)	(−0.91)	(−0.88)	(−0.59)	(−0.75)	(−0.73)	(−0.67)	(−0.25)	(−0.07)	(−0.06)	(0.04)	(0.4)
`TAXGrate`	**−0.0784** ***	**−0.0782** ***	**−0.0700** ***	**−0.0695** ***	**−0.0682** ***	**−0.0661** ***	**−0.0510** ***	**−0.0503** ***	**−0.0349** ***	**−0.0332** ***	**−0.0183** *	**−0.0180** *
	(−6.25)	(−6.11)	(−4.20)	(−4.17)	(−5.45)	(−5.20)	(−3.09)	(−3.05)	(−4.54)	(−4.24)	(−1.81)	(−1.77)
`M3Grate`	**0.0770** *	0.0736	0.0577	0.0566	0.0329	0.00781	−0.0207	−0.0226	−0.0164	−0.0365	**−0.0647** *	**−0.0656** *
	(1.69)	(1.37)	(1)	(0.98)	(0.73)	(0.15)	(−0.37)	(−0.40)	(−0.59)	(−1.12)	(−1.86)	(−1.88)
`FTSE100Re`	**0.0160** **	**0.0160** **	**0.0187** **	**0.0176** **	0.0095	0.0094	**0.0146** *	0.0141	0.0042	0.0041	**0.009** *	**0.0087** *
	(2.08)	(2.08)	(2.21)	(2.04)	(1.25)	(1.23)	(1.72)	(1.63)	(0.91)	(0.89)	(1.77)	(1.67)
`Tang`	−0.0495	−0.0495	−0.0504	−0.0485	−0.0169	−0.0163	−0.0179	−0.0159	−0.0193	−0.019	−0.0207	−0.0194
	(−0.86)	(−0.86)	(−0.87)	(−0.84)	(−0.30)	(−0.29)	(−0.32)	(−0.28)	(−0.56)	(−0.55)	(−0.60)	(−0.56)
`CRatio`	**−0.008** ***	**−0.008** ***	**−0.008** ***	**−0.008** ***	**−0.0084** ***	**−0.0084** ***	**−0.0084** ***	**−0.0084** ***	**−0.0116** ***	**−0.0116** ***	**−0.0116** ***	**−0.0116** ***
	(−18.21)	(−18.21)	(−18.21)	(−18.21)	(−19.55)	(−19.55)	(−19.54)	(−19.54)	(−22.95)	(−22.96)	(−22.96)	(−22.97)
`Growthopp`	−0.0014	−0.0014	−0.0014	−0.0014	−0.0022	−0.0022	−0.0022	−0.0022	−0.001	−0.001	−0.001	−0.001
	(−0.84)	(−0.84)	(−0.84)	(−0.83)	(−1.32)	(−1.31)	(−1.30)	(−1.30)	(−1.02)	(−1.01)	(−0.99)	(−0.99)
`Prof`	**−0.0014** ***	**−0.0014** ***	**−0.0014** ***	**−0.0014** ***	**−0.0018** ***	**−0.0018** ***	**−0.0018** ***	**−0.0018** ***	**−0.0009** ***	**−0.0009** ***	**−0.0009** ***	**−0.0009** ***
	(−4.14)	(−4.14)	(−4.15)	(−4.15)	(−5.40)	(−5.41)	(−5.42)	(−5.42)	(−4.92)	(−4.92)	(−4.94)	(−4.94)
`FSize`	**−0.0141** ***	**−0.0140** ***	**−0.0139** ***	**−0.0138** ***	−0.002	−0.0017	−0.0015	−0.0015	**0.0018** *	**0.0019** **	**0.0021** **	**0.0021** **
	(−6.86)	(−6.76)	(−6.62)	(−6.57)	(−1.32)	(−1.14)	(−1.03)	(−0.98)	(1.84)	(1.96)	(2.15)	(2.18)
`Crisis`$_{D}$	**−0.0107** **	**−0.0112** *	**−0.0127** *	**−0.0142** *	**−0.0212** ***	**−0.0248** ***	**−0.0274** ***	**−0.0277** ***	**−0.0203** ***	**−0.0232** ***	**−0.0257** ***	**−0.0260** ***
	(−2.11)	(−1.72)	(−1.86)	(−1.85)	(−4.34)	(−3.95)	(−4.20)	(−3.72)	(−6.62)	(−5.93)	(−6.32)	(−5.58)
`M3Grate` ∗ `Crisis`$_{D}$		0.0117	0.031	0.155		0.0878	0.122	**0.256** **		0.0735	**0.107** *	**0.193** ***
		(0.12)	(0.3)	(1.3)		(0.89)	(1.2)	(2.16)		(1.19)	(1.69)	(2.6)
`TAXGrate` ∗ `Crisis`$_{D}$			−0.0193	**−0.207** **			−0.0363	**−0.235** **			**−0.0359** **	**−0.164** ***
			(−0.77)	(−2.12)			(−1.44)	(−2.40)			(−2.30)	(−2.68)
`FTSE100Re` ∗ `Crisis`$_{D}$				**0.125** *				**0.129** **				**0.0833** **
				(1.91)				(1.98)				(2.04)
`RiskP` ∗ `Crisis`$_{D}$				−0.062				**−0.0768** **				**−0.0489** **
				(−1.63)				(−2.01)				(−2.05)
Adjusted R2	0.21%	0.22%	0.24%	0.26%	4.61%	4.74%	4.84%	4.90%				
Wald chi2									0.000	0.000	0.000	0.000
N	9952	9952	9952	9952	9952	9952	9952	9952	9951	9951	9951	9951

Table 13. The estimation results for models 3–6 (including RiskP and IPGrate). T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

Variables	**FEM**				**REM**				**Tobit**			
	3	**4**	**5**	**6**	**3**	**4**	**5**	**6**	**3**	**4**	**5**	**6**
RiskP	−0.011	−0.0109	−0.0176	−0.0189	−0.0092	−0.0091	−0.0137	−0.0128	−0.001	−0.00101	−0.0019	−0.00103
	(−1.03)	(−1.02)	(−1.61)	(−1.60)	(−0.86)	(−0.85)	(−1.26)	(−1.08)	(−0.15)	(−0.15)	(−0.28)	(−0.14)
IPGrate	**−0.332** ***	**−0.335** ***	**−0.592** ***	**−0.592** ***	**−0.297** ***	**−0.301** ***	**−0.479** ***	**−0.475** ***	**−0.156** ***	**−0.158** ***	**−0.194** ***	**−0.191** ***
	(−6.48)	(−6.53)	(−6.12)	(−6.09)	(−5.81)	(−5.88)	(−5.00)	(−4.93)	(−4.96)	(−5.02)	(−3.34)	(−3.27)
M3Grate	−0.0324	−0.0704	−0.0654	−0.0652	−0.0621	**−0.114** **	**−0.112** **	**−0.113** **	**−0.0656** **	**−0.0974** ***	**−0.0969** ***	**−0.0972** ***
	(−0.77)	(−1.44)	(−1.34)	(−1.33)	(−1.48)	(−2.33)	(−2.30)	(−2.32)	(−2.54)	(−3.27)	(−3.26)	(−3.27)
FTSE100Re	0.0143	**0.0151***	0.00012	0.000896	0.0086	0.00983	−0.000826	0.000604	0.00375	0.00449	0.00232	0.00326
	(1.89)	(2)	(0.01)	(0.1)	(1.14)	(1.3)	(−0.09)	(0.07)	(0.82)	(0.98)	(0.43)	(0.6)
Tang	−0.0509	−0.0503	−0.0447	−0.0436	−0.0178	−0.0166	−0.0127	−0.0114	−0.0199	−0.0193	−0.0185	−0.0175
	(−0.88)	(−0.87)	(−0.78)	(−0.76)	(−0.31)	(−0.29)	(−0.22)	(−0.20)	(−0.58)	(−0.56)	(−0.53)	(−0.51)
CRatio	**−0.0081** ***	**−0.0081** ***	**−0.0081** ***	**−0.0081** ***	**−0.0084** ***	**−0.0084** ***	**−0.0085** ***	**−0.0085** ***	**−0.0116** ***	**−0.0116** ***	**−0.0116** ***	**−0.0116** ***
	(−18.20)	(−18.22)	(−18.26)	(−18.29)	(−19.54)	(−19.54)	(−19.59)	(−19.62)	(−22.94)	(−22.95)	(−22.95)	(−22.97)
Growthopp	−0.0014	−0.0013	−0.0011	−0.001	−0.0021	−0.0021	−0.002	−0.0019	−0.001	−0.0009	−0.0009	−0.0009
	(−0.83)	(−0.80)	(−0.68)	(−0.62)	(−1.30)	(−1.25)	(−1.19)	(−1.14)	(−0.97)	(−0.91)	(−0.89)	(−0.85)
Prof	**−0.0014** ***	**−0.0014** ***	**−0.0014** ***	**−0.0014** ***	**−0.002** ***	**−0.002** ***	**−0.002** ***	**−0.002** ***	**−0.001** ***	**−0.001** ***	**−0.001** ***	**−0.001** ***
	(−4.19)	(−4.19)	(−4.15)	(−4.13)	(−5.44)	(−5.44)	(−5.43)	(−5.42)	(−4.96)	(−4.95)	(−4.94)	(−4.93)
FSize	**−0.0138** ***	**−0.0134** ***	**−0.0145** ***	**−0.0147** ***	−0.0018	−0.0014	−0.0018	−0.00185	**0.0018** *	**0.002** **	**0.0019** **	**0.0019** *
	(−6.74)	(−6.50)	(−6.94)	(−6.98)	(−1.23)	(−0.98)	(−1.20)	(−1.20)	(1.9)	(2.08)	(1.97)	(1.94)
Crisis$_D$	**−0.0177** ***	**−0.0237** ***	**−0.0208** **	0.0123	**−0.0273** ***	**−0.0354** ***	**−0.0338** ***	0.00246	**−0.0235** ***	**−0.0285** ***	**−0.0282** ***	−0.0046
	(−3.47)	(−3.67)	(−3.19)	(0.8)	(−5.53)	(−5.65)	(−5.37)	(0.16)	(−7.58)	(−7.33)	(−7.18)	(−0.49)
M3Grate ∗ Crisis$_D$		0.148	0.132	−0.16		**0.202** **	**0.194** **	−0.109		**0.131** **	**0.129** **	−0.0646
		(1.52)	(1.36)	(−1.06)		(2.08)	(2)	(−0.72)		(2.16)	(2.13)	(−0.69)
IPGrate ∗ Crisis$_D$			**0.397** **	**2.375** **			**0.277** **	**2.347** ***			**0.0571**	**1.382** ***
			(3.13)	(2.98)			(2.2)	(2.94)			(0.74)	(2.78)
FTSE100Re ∗ Crisis$_D$				**−0.406** *				**−0.428** ***				**−0.275** ***
				(−2.49)				(−2.63)				(−2.70)
RiskP ∗ Crisis$_D$				0.0322				0.0177				0.00905
				(0.98)				(0.54)				(0.44)
Adjusted R2	0.25%	0.30%	0.19%	0.19%	4.70%	4.90%	4.75%	4.79%				
Wald chi2									0.000	0.000	0.000	0.000
N	9952	9952	9952	9952	9952	9952	9952	9952	9951	9951	9951	9951

Table 14. The results' signs versus Research Hypotheses.

Variable, Theory, Hypothesis and Sign				Model Sign FE	RE	Tobit
Business Cycle	TOT	$H1_B$	+			
	POT	$H1_A$	−	−	−	−
	MTT	N/A	N/A			
Credit Supply	TOT	H2	+	+	+	+
	POT	H2	+	+	+	+
	MTT	N/A	N/A			
Final Market Risk	TOT	$H3_B$	−			
	POT	$H3_A$	+			
	MTT	N/A	N/A			
Stock Market Performance	TOT	$H4_A$	+	+	+	+
	POT	$H4_B$	−			
	MTT	$H4_B$	−			

Table 15. The results' signs versus Research Hypotheses before and after crisis.

				Pre-Crisis Sign			Post-Crisis Sign		
Variable, Theory, Hypothesis and Sign				FE	RE	Tobit	FE	RE	Tobit
Business Cycle	TOT	$H1_B$	+						
	POT	$H1_A$	−	−	−	−	−	−	−
	MTT	N/A	N/A						
Credit Supply	TOT	H2	+	+			+	+	+
	POT	H2	+	+			+	+	+
	MTT	N/A	N/A		−	−			
Final Market Risk	TOT	$H3_B$	−				−	−	−
	POT	$H3_A$	+						
	MTT	N/A	N/A						
Stock Market Performance	TOT	$H4_A$	+	+	+	+	+	+	+
	POT	$H4_B$	−						
	MTT	$H4_B$	−						

5.3. Robustness Check Results

We performed a series of robustness checks by using various proxies to measure macroeconomic variables and various estimation strategies, such as Generalised Least Square (GLS), System Generalised Methods of Moments (SGMM) and Difference Generalised Methods of Moments (DGMM) models, that can confirm the validity of our findings. For the robustness check using model specifications 1 and 2, we used `ComPaperSp` as a proxy to measure the financial market risk, and we present the results in Table 8a,b. In addition, we used `IPGrate` to measure the business cycle, and we present the results in Tables 8 and 9, whereas the robustness check results of model specification 3 to 6, which do consider the effect of the 2008 crisis, using `ComPaperSp` as a proxy, are in Tables 10 and 11, and those using `IPGrate` as a proxy for the robustness check are in Tables 11 and 13. Furthermore, we presented the comparison of our selected static estimation strategies, namely FEM, REM, Tobit, and GLS, and dynamic estimation strategies, namely SGMM and DGMM, using model 1 in Tables 16–19.

Table 16. Comparison of Static and Dynamic estimation results for robustness check using model 1 (including `ComPaperSp` and `TAXGrate`). T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

Variable	FEM	REM	Tobit	GLS	SGMM	DGMM
`ComPaperSp`	−0.0078	−0.0115	−0.00749	**−0.0169** **	**0.0496** ***	**0.0310** **
	(−0.95)	(−1.39)	(−1.48)	(−2.46)	(−3.52)	(−2.18)
`TAXGrate`	**−0.162** ***	**−0.0791** ***	**−0.0436** ***	**−0.0876** ***	−0.0253	−0.033
	(−5.61)	(−5.79)	(−5.23)	(−8.32)	(−1.09)	(−1.23)
`M3Grate`	**0.165** ***	**0.206** ***	**0.142** ***	**0.297** ***	**−0.135** **	−0.059
	(−4.49)	(−5.65)	(−6.27)	(−10.6)	(−1.98)	(−0.79)
`FTSE100Re`	**0.0199** ***	**0.0144** *	0.00734	0.00852	0.0224	0.0103
	(−2.65)	(−1.91)	(−1.62)	(−1.44)	(−1.08)	(−0.4)
`Tang`	−0.0508	−0.02	−0.0221	**0.0760** *	0.0354	−0.0295
	(−0.88)	(−0.35)	(−0.64)	(−1.83)	(−0.37)	(−0.21)
`CRatio`	**−0.00808** ***	**−0.00843** ***	**−0.0114** ***	**−0.00900** ***	**−0.00940** ***	**−0.00748** ***
	(−18.14)	(−19.42)	(−22.77)	(−33.70)	(−6.10)	(−5.57)
`Growthopp`	−0.00114	−0.00177	−0.000599	0.0000676	−0.00489	−0.00101
	(−0.68)	(−1.05)	(−0.57)	(−0.05)	(−1.57)	(−0.36)
`Prof`	**−0.00139** ***	**−0.00182** ***	**−0.000981** ***	**−0.00473** ***	**−0.00219** ***	**−0.00961** **
	(−4.12)	(−5.42)	(−4.94)	(−3.94)	(−3.90)	(−2.32)
`FSize`	**−0.0155** ***	**−0.00368** **	−0.000011	**0.0174** ***	**−0.0142** **	−0.00716
	(−8.11)	(−2.49)	(−0.01)	(−37.82)	(−2.05)	(−0.57)
$\texttt{Lev}_{t-1}$					**0.690** ***	**0.615** ***
					(−24.76)	(17.98)
Adjusted R2, overall	0.09%	3.68%				
Wald chi2 (Prob > chi2)			0.000	0.000	0.000	0.000
Sargan test (Prob > chi2)					0.000	0.000
Hansen test (Prob > chi2)					0.000	0.074
N	9952	9952	9951	9952	9495	8605

Table 17. Comparison of Static and Dynamic estimation results for robustness check using model 1 (including`ComPaperSp` and `IPGrate`). T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

Methods	FEM	REM	Tobit	GLS	SGMM	DGMM
`ComPaperSp`	−0.0085	−0.0107	−0.00566	−0.00893	**0.0441** ***	**0.0428** ***
	(−1.02)	(−1.28)	(−1.11)	(−1.27)	(−2.67)	(−2.91)
`IPGrate`	**−0.332** ***	**−0.285** ***	**−0.137** ***	**−0.215** ***	0.00144	0.103
	(−5.89)	(−5.06)	(−4.01)	(−4.75)	(−0.01)	(−0.43)
`M3Grate`	**0.0940** **	**0.137** ***	**0.0991** ***	**0.183** ***	**−0.0865** *	−0.0839
	(−2.96)	(−4.36)	(−5.11)	(−7.13)	(−1.67)	(−1.52)
`FTSE100Re`	**0.0171** *	0.0103	0.00397	−0.00213	−0.0128	−0.0348
	(−2.31)	(−1.4)	(−0.9)	(−0.36)	(−0.23)	(−0.75)
`Tang`	−0.0538	−0.0227	−0.0239	0.0235	0.0275	−0.0409
	(−0.93)	(−0.40)	(−0.70)	(−0.55)	(−0.29)	(−0.29)
`CRatio`	**−0.00805** ***	**−0.00841** ***	**−0.0114** ***	**−0.00994** ***	**−0.00941** ***	**−0.00749** ***
	(−18.06)	(−19.35)	(−22.73)	(−27.09)	(−6.11)	(−5.61)
`Growthopp`	−0.00102	−0.00171	−0.000581	−0.000177	**−0.00528** *	−0.000701
	(−0.60)	(−1.02)	(−0.55)	(−0.12)	(−1.68)	(−0.25)
`Prof`	**−0.00141** ***	**−0.00184** ***	**−0.000989** ***	**−0.00486** ***	**−0.00229** ***	**−0.00977** **
	(−4.16)	(−5.47)	(−4.98)	(−4.05)	(−4.12)	(−2.34)
`FSize`	**−0.0161** ***	**−0.00393** ***	−0.000116	**0.0170** ***	**−0.0112** *	−0.00284
	(−8.37)	(−2.65)	(−0.12)	(−36.36)	(−1.86)	(−0.32)
`Lev`$_{t-1}$					**0.690** ***	**0.618** ***
					−24.87	−18.12
Adjusted R2, overall	0.05%	3.52%				
Wald chi2 (Prob > chi2)			0.000	0.000	0.000	0.000
Sargan test (Prob > chi2)					0.000	0.000
Hansen test (Prob > chi2)					0.000	0.102
N	9952	9952	9951	9952	9495	8605

Table 18. Comparison of Static and Dynamic estimation results for robustness check using model 1 (including `RiskP` and `TAXGrate`).T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

Methods	**FEM**	**REM**	**Tobit**	**GLS**	**SGMM**	**DGMM**
`RiskP`	−0.00829	−0.00454	0.00322	−0.0134	**0.0367** ***	0.0268
	(−0.78)	(−0.42)	(−0.49)	(−1.56)	(−2.6)	(−1.1)
`TAXGrate`	**−0.0809** ***	**−0.0717** ***	**−0.0383** ***	**−0.0792** ***	**−0.0398** *	−0.0313
	(−6.47)	(−5.74)	(−5.02)	(−8.17)	(−1.65)	(−1.10)
`M3Grate`	**0.149** ***	**0.179** ***	**0.121** ***	**0.265** ***	−0.0165	−0.00682
	(−4.93)	(−5.95)	(−6.47)	(−11.45)	(−0.37)	(−0.09)
`FTSE100Re`	**0.0177** **	0.0122	0.0069	0.00454	0.0138	0.00387
	(−2.31)	(−1.59)	(−1.5)	(−0.74)	(−0.63)	(−0.13)
`Tang`	−0.0512	−0.0206	−0.0224	**0.0802** *	0.0358	−0.0331
	(−0.89)	(−0.36)	(−0.65)	(−1.96)	(−0.37)	(−0.23)
`CRatio`	**−0.00807** ***	**−0.00842** ***	**−0.0114** ***	**−0.00891** ***	**−0.00949** ***	**−0.00752** ***
	(−18.12)	(−19.39)	(−22.75)	(−34.02)	(−6.14)	(−5.60)
`Growthopp`	−0.00112	−0.00175	−0.000597	0.0000515	−0.00497	−0.000825
	(−0.67)	(−1.04)	(−0.57)	(−0.04)	(−1.59)	(−0.29)
`Prof`	**−0.00139** ***	**−0.00182** ***	**−0.000974** ***	**−0.00471** ***	**−0.00226** ***	**−0.00956** **
	(−4.11)	(−5.40)	(−4.91)	(−3.92)	(−4.00)	(−2.36)
`FSize`	**−0.0157** ***	**−0.00383** ***	−0.0000785	**0.0174** ***	**−0.0122** *	−0.00557
	(−8.24)	(−2.60)	(−0.08)	(−37.86)	(−1.74)	(−0.38)
$\mathtt{Lev}_{t-1}$					**0.687** ***	**0.613** ***
					−24.78	−18.1
Adjusted R2, overall	0.08%	3.60%				
Wald chi2 (Prob > chi2)			0.000	0.000	0.000	0.000
Sargan test (Prob > chi2)					0.000	0.000
Hansen test (Prob > chi2)					0.000	0.047
N	9952	9952	9951	9952	9495	8605

Table 19. Comparison of Static and Dynamic estimation results for robustness check using model 1 (including RiskP and IPGrate). T-statistics are in parentheses. *, **, and *** denote statistically significant at 10%, 5% and 1% level respectively.

Methods	FEM	REM	Tobit	GLS	SGMM	DGMM
RiskP	−0.0079 (−0.74)	−0.00376 (−0.35)	0.00407 (−0.63)	−0.00429 (−0.49)	**0.0352** ** (−2.01)	0.00377 (−0.16)
IPGrate	**−0.310** *** (−6.10)	**−0.254** *** (−5.02)	**−0.119** *** (−3.87)	**−0.194** *** (−4.77)	−0.08 (−0.54)	−0.244 (−1.15)
M3Grate	**0.0798** ** (−2.96)	**0.117** *** (−4.37)	**0.0857** *** (−5.18)	**0.168** *** (−7.67)	−0.0339 (−0.89)	0.0203 (−0.29)
FTSE100Re	0.0148 (−1.96)	0.00839 (−1.11)	0.00397 (−0.88)	−0.0037 (−0.61)	−0.0195 (−0.65)	0.0173 (−0.46)
Tang	−0.0541 (−0.94)	−0.023 (−0.41)	−0.024 (−0.70)	0.0269 (−0.64)	0.0221 (−0.23)	−0.0505 (−0.35)
CRatio	**−0.00804** *** (−18.03)	**−0.00840** *** (−19.33)	**−0.0114** *** (−22.71)	**−0.00990** *** (−27.13)	**−0.00948** *** (−6.15)	**−0.00756** *** (−5.54)
Growthopp	−0.00101 (−0.60)	−0.00172 (−1.02)	−0.000595 (−0.57)	−0.000196 (−0.14)	−0.00474 (−1.53)	−0.000818 (−0.30)
Prof	**−0.00140** *** (−4.15)	**−0.00183** *** (−5.45)	**−0.000982** *** (−4.95)	**−0.00486** *** (−4.05)	**−0.00228** *** (−4.08)	**−0.00990** ** (−2.30)
FSize	**−0.0162** *** (−8.46)	**−0.00403** *** (−2.72)	−0.000132 (−0.14)	**0.0170** *** (−36.32)	**−0.0123** * (−1.89)	−0.00228 (−0.25)
Lev_{t-1}					**0.690** *** (−24.95)	**0.617** *** (−18.08)
Adjusted R2, overall	0.04%	3.47%				
Wald chi2 (Prob > chi2)			0.000	0.000	0.000	0.000
Sargan test (Prob > chi2)					0.000	0.000
Hansen test (Prob > chi2)					0.000	0.031
N	9952	9952	9951	9952	9495	8605

Our results illustrate that the business cycle has a negative effect on `Lev`, which is in line with POT and our H1. The `M3Grate` does not have a significant explanatory power on `Lev`. Furthermore, these models report a positive impact for `ComPaperSp`, and `RiskP` impacts on `Lev`, which is in line with POT and our H3. Lastly, the models do not report any significant explanatory power for the effect of `FTSE100Re` on `Lev`. This shows that our results are sensitive to applying GMM regression models, and hence shows the importance of taking into account the dynamic nature of capital structure and controlling for endogeneity. Tables 20 and 21 report the the GLS, SGMM and DGMM results' signs versus our research hypotheses. Note that we have further performed models 2–6 using GLS, SGMM and DGMM estimation strategies. However, including these results in this manuscript would lead to an unnecessarily long list of tables, which, for the sake of completeness, are made available online at [47].

Table 20. The Robustness Check results' signs versus Research Hypotheses.

				Model Sign		
Variable, Theory, Hypothesis and Sign				**GLS**	**SGMM**	**DGMM**
Business Cycle	TOT	$H1_A$	+			
	POT	H1	−	−	−	−
	MTT	N/A	N/A			
Credit supply	TOT	H2	+	+		
	POT	H2	+	+		
	MTT	N/A	N/A			
Final Market Risk	TOT	$H3_A$	−	−		
	POT	H3	+		+	+
	MTT	N/A	N/A			
Stock Market Performance	TOT	H4	+	+		
	POT	$H4_A$	−			
	MTT	$H4_A$	−			

Table 21. The Robustness Check results' signs versus Research Hypotheses before and after crisis.

				Pre-Crisis Sign				Post-Crisis Sign			
Variable, Theory, Hypothesis and Sign				**FE**	**RE**	**Tobit**	**GLS**	**FE**	**RE**	**Tobit**	**GLS**
Business Cycle	TOT	$H1_A$	+								
	POT	H1	−	−	−	−	−	−	−	−	−
	MTT	N/A	N/A								
Credit supply	TOT	H2	+	+			+	+	+	+	+
	POT	H2	+	+			+	+	+	+	+
	MTT	N/A	N/A		−	−					
Final Market Risk	TOT	$H3_A$	−				−	−	−	−	−
	POT	H3	+								
	MTT	N/A	N/A								
Stock Market Performance	TOT	H4	+	+	+	+	+	+	+	+	+
	POT	$H4_A$	−								
	MTT	$H4_A$	−								

6. Discussion and Conclusions

Using an unbalanced panel of 922 non-financial firms publicly listed on LSE during 1995 and 2014, we empirically examine the predictions of three theories on capital structure, namely TOT, POT and MTT. We find that (1) capital structure is counter-cyclical; (2) firms increase leverage when financial market risk subsides, but reduce leverage when market risk rises; (3) leverage is positively related to the money supply; (4) firms tend to raise more debt when the stock market performance improves, which is against the prediction of MTT; and (5) the effect of macroeconomic variables on firm leverage becomes more attenuated after the 2008 financial crisis. Overall, our results are supportive of POT, although TOT cannot be outright rejected.

The policy implications of our study are threefold. First, our results show that the business cycle is negatively associated with leverage, which is in line with the prediction of POT ($H1_A$) and previous studies [9–11]. In particular, leverage is counter-cyclical. When corporate taxes or industrial production are high, firms tend to rely on their internal funds and issue less debt relative to equities. They may even retire some of their short-term debt so that the leverage ratio can be reduced. An important implication is that, if the government implements contractionary fiscal or monetary policies by raising taxes or the interest rate during business cycle expansion, then the tax benefits of debt may increase and firms have more incentive to seek financing through borrowing, thereby increasing leverage. Higher leverage, coupled with better investment opportunities during the expansion stage, may further fuel economic growth. On the other hand, if the government adopts expansionary fiscal or monetary policies in order to encourage business borrowing during business cycle downturn, the policies may not be effective because the leverage ratio is high during the downturn and firms will be reluctant to take out more loans and increase their leverage further.

Second, our results show that if the M3 growth rate is high, then firms tend to issue more debt, but if the financial market risk is high, then firms will reduce borrowing. Thus, consistent with previous research [18,19,48–50], the credit supply has a positive effect on capital structure, whereas yjr financial market risk has a negative effect. An important implication is that, when the central bank (i.e., Bank of England) conducts quantity easing during the financial crisis, the effect on firms' borrowing behaviour is likely to be mixed. On one hand, more credit supply allows financially constrained firms to take out loans to finance their operation. On the other hand, when faced with higher economic uncertainty, firms may refrain from increasing their leverage. Hence, the net policy effect of quantity easing could largely be unknown. As Figure 2 illustrates, on average, firms' leverage actually decreased during the 2008 financial crisis when the Bank of England implemented several rounds of quantitative easing, suggesting that the leverage reduction effect from market uncertainties outweighed the leverage enhancement effect from quantitative easing. Third, our results show that the relationship between the financial market risk and leverage turns significantly negative when a dummy variable capturing the 2008 financial crisis is included in the regressions. In other words, financial market risk negatively affects capital structure only during the post-crisis period, which is in line with the results of previous studies [20,51,52]. An important implication is that a sudden deterioration in market risk sentiment during the financial crisis may complicate the effectiveness of defensive government policies. Complications may arise during the crisis because it is not clear whether changes in capital structure are due to a supply shift (banks were unwilling to lend) or demand shift (firms refrain from borrowing due to high economic uncertainty).

In summary, our findings indicate that the impact of macroeconomic conditions on firms' capital structure is of more statistical significance after the 2008 financial crisis. As a result of the increase in the financial market risk and the counter-cyclical pattern of firm leverage, expansionary fiscal and monetary policies may not affect firms' financial decisions. As a consequence, the government needs to carefully evaluate the aftermath of its policies before they intervene. Our approach is different from previous research in three ways. First, most of the existing capital structure studies use firm-specific variables and some studies have used the impact of macroeconomic variables on capital structure. However, no previous study has studied all of the six macroeconomic variables, including `IPGrate`,`TAXGrate`, `ComPaperSp`, `RiskP`, `M3Grate`and `FTSE100Re`, to analyse the capital structure. Second, we developed our hypotheses to analyse the impact of the stated macroeconomic variables under the capital structure theories, but other studies that have studied macroeconomic conditions do not establish the hypothesis under the capital structure theories. Lastly, we use macroeconomic variables to reduce the endogeneity that might arise using firm-specific variables to test capital structure. Furthermore, we use Tobit and GMM models to consider the truncation and dynamic nature of leverage, respectively. This makes our approach different from the previous research, as there is no existing study that has considered all of the aforementioned econometric issues at the same time. Although we have obtained some interesting findings in this article, there are some limitations and areas requiring further future investigations:

- As the data were not available for the financial market risk variable over the period 1980–2014, this study was limited to a shorter period of time, although we aim to collect missing data in order to be able to strengthen our analysis in future work;
- More proxies can also be used to measure macroeconomic variables, such as aggregated commercial paper and bank-loan supply, which can be used for the business cycle—as carried out in [53];
- The use of other dynamic models, such as the nested logit model, might also help us strengthen our future analyses;
- Lastly, instead of limiting our attention to the 'great recession' that occurred in 2008, we plan on including the so-called 2011 'Euro area sovereign debt crisis' in future investigations.

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