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Determinants of capital structure: new evidence from Spanish panel data

Alberto de Miguel, Julio Pindado *

Departamento de Análisis Económico y Contabilidad, Universidad de Salamanca, Salamanca, E37007, Spain

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Abstract

This paper analyzes the firm characteristics which are determinants of capital structure according to different explanatory theories, and how institutional characteristics affect capital structure. We have developed a target adjustment model, which has then been confirmed by our empirical evidence. It highlights the fact that the transaction costs borne by Spanish firms are inferior to those borne by US firms. Our results are consistent with tax and financial distress theories and with the interdependence between investment and financing decisions; they also provide additional evidence on the pecking order and free cash flow theories. Finally, the evidence obtained confirms the impact of some institutional characteristics on capital structure.

JEL classification: G32
Keywords: Capital structure; Institutional characteristics; Cash flow; Free cash flow

1. Introduction

Since the seminal work by Modigliani and Miller (1958), a vast amount of literature has been generated. Part of this literature materialized into a series of theoretical and empirical studies whose objective has been to determine the explanatory factors of capital structure. Thus, there is a transition from Miller's (1977) postulate of tax neutrality—later refuted by DeAngelo and Masulis (1980), who introduced the concept

* Corresponding author. Tel.: +34-923-294400; fax: +34-923-294715.
E-mail address: pindado@gugu.usal.es (J. Pindado).

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of non-debt tax shields—to the static theory, which postulates the optimum debt level as a consequence of a trade-off between the tax advantages of borrowed money and financial distress costs. Finally, some aspects related to asymmetric information and the agency theory (pecking order and free cash flow theories) have been introduced into the analysis, not forgetting the well known relationship between debt and investment. These relationships have mainly been tested for US firms obtaining the results shown in Section 2. However, there is little evidence about non-US firms. To this respect, we should point out the studies by Rajan and Zingales (1995), Wald (1999) and Mcclure et al. (1999), which provide evidence for the G-7 countries. These papers reveal several differences between countries in their firm-specific characteristics that determine capital structure, which according to the first two studies, could be explained by the different institutional features.

With regard to the subject under discussion, the purpose of this paper is to provide additional international empirical evidence on capital structure in two aspects. First, we provide evidence of firm characteristics that determine capital structure for a non-G-7 country, namely Spain. Second, we study how the institutional characteristics affect capital structure. The latter aspect allows us to compare our results with others obtained for US firms and to explain their differences.

In order to study the debt of Spanish firms, we have developed a target adjustment model which allows us to explain the firms' debt in terms of their debt in the previous period and the firms' target debt level, the latter being a function depending on the firm characteristics which, according to the different theories, explain capital structure. The development of the target adjustment model leads to the econometric specification of a dynamic model with predetermined variables, which has been estimated using the Generalized Method of Moments.

Our empirical evidence corroborates the proposed model. The results show that firms bear considerable transaction costs when they decide to adjust their debt ratio in the previous period to their target level in the current period, even though these transaction costs are inferior to those found in other studies for US firms; the explanation lies in the higher level of private debt that exists in Spanish firms. Moreover, the expected relationships for the debt ratio have been obtained, i.e. the debt ratio is inversely related to cash flow, non-debt tax shields and financial distress costs, and directly related to investment. In addition, our results confirm that the inverse relationship between debt and cash flow arises because of the presence of asymmetric information, which leads firms to worry about the under-investment problem as postulated by the pecking order theory. However, in the absence of asymmetric information, firms are more concerned about the problem of over-investment, which means that they issue debt in order to eliminate the managers' incentive to invest in projects with a negative net present value, as the free cash flow theory postulates. Finally, our results show that this problem is mitigated by the highly concentrated ownership of Spanish firms, and the advantage provided by private debt is not as great as that provided by access to the bond market.

The remainder of this paper is organized as follows. Section 2 outlines previous studies on capital structure in order to then develop the target adjustment model in Section 3. In Section 4, we use Spanish firms' panel data to estimate the model. In this section, the results are discussed according to financial theory, and additional empirical

evidence is obtained on the pecking order and free cash flow theories and the impact of institutional characteristics on capital structure. Finally, our conclusions are presented in Section 5.

2. Determinants of capital structure: previous studies

As a starting point for our investigation, we will outline previous studies, highlighting those aspects which have contributed to the explanation of capital structure. Our objective is to collect the results of previous investigation before elaborating an explanatory model of capital structure. In this section, we reflect on two strands of relevant literature. The first strand includes an overview of theoretical and empirical work that analyzes firm characteristics as determinants of capital structure in the US. The second one studies institutional characteristics that can also affect capital structure. In this second section, we analyze some studies based on cross-country comparisons of capital structure. As these studies explain, the differences in capital structure between countries are due to their different institutional characteristics. Therefore, it is worth introducing into this discussion Spanish institutional characteristics and their likely impact on capital structure.

2.1. Firm characteristics as determinants of capital structure

We analyze the major firm characteristics that determine capital structure in order to establish a theoretical framework, and also to take into consideration the empirical results obtained from US firms.

2.1.1. Tax aspects of capital structure

Literature on this subject has concentrated on the competition between tax deductibility of debt and the other non-debt tax shields (hereafter, NDTS). This competition makes the expected relationship between debt and NDTS inverse. This hypothesis has been the object of empirical testing, a noteworthy study being that of Titman and Wessels (1988), who propose a closed analytical formula for the calculation of NDTS, which has been followed by later studies. Although Titman and Wessels did not obtain significant results for this variable, later Barton et al. (1989) and Prowse (1990) did obtain significant results for an inverse relationship between debt and NDTS. However, more recent studies (e.g. Grier and Zychowicz, 1994; Bathala et al., 1994) complicate the scenario described previously because they achieve a direct relationship between these variables.

The contradictions found in the above studies lead us to consider a possible explanation using models which contemplate a different structure for the variables. Along these lines, we highlight MacKie-Mason's (1990) contribution, which proposes the separation of NDTS into two parts: investment tax credits and tax loss carry-forwards. The argument which justifies the aforementioned separation is based on the different relationship that these variables may have with the debt level, the first part of NDTS being directly related and the second part inversely related.

2.1.2. Aspects of capital structure related to asymmetric information and agency problems

In addition to the tax aspects, there are some factors which may contribute to the explanation of capital structure from the perspective of asymmetric information and agency problems originating in credit markets.

A very important characteristic of debt is that its owners have priority in reclaiming it over the shareholders' rights. This circumstance creates problems in those credit markets with asymmetric information, as a consequence of the conflict of interests between shareholders and bondholders. As Myers (1977) indicates, it can encourage the shareholders not to carry out or to abandon investment projects with a positive net present value whenever the net present value of the investment is less than the amount of debt issued. Furthermore, this conflict has another dimension. Given the limited liability of shareholders, they are encouraged to undertake investment projects of greater risk, taking advantage of the possibility of increasing their benefits at the expense of increasing the risk, which is passed on to the bondholders, who are the ones that would suffer the possible losses (Jensen and Meckling, 1976). Therefore, there is a moral hazard problem, which decreases proportionately to the amount of committed investments already in place. To determine to what extent these problems explain the debt level, the tangible fixed assets variable has been proposed to indicate the importance of the tangible fixed assets which have already been committed. This variable has a direct and significant relationship with the debt level according to Prowse (1990), MacKie-Mason (1990), Smith and Watts (1992), Jensen et al. (1992) and Grier and Zychowicz (1994).

Moreover, it can be argued that the existence of intangible assets points towards future investment decisions and their value will depend on these decisions; besides, these assets cannot be easily controlled or assessed by potential external investors. Furthermore, the intangible assets have a low residual value, which affects the financial structure of firms. Thus, the debt level must be very low, otherwise, the presence of asymmetric information would create a moral hazard problem because the shareholders would be willing to take on larger risks as long as the liquidation value of the assets was lower than the debt value. Consequently, an inverse relationship will exist between the proportion of intangible assets and the debt level, as shown by MacKie-Mason (1990), Jensen et al. (1992), John (1993) and Bathala et al. (1994).

The existence of asymmetric information makes firms give priority to resources generated internally over debt, according to the pecking order theory. In line with this theory, the relationship between the capacity to generate resources and the debt level must be inverse as shown by Baskin (1989), Jensen et al. (1992), John (1993), Grier and Zychowicz (1994) and Bathala et al. (1994). In general, profits have been taken into account when measuring the capacity to generate internal resources. However, from our point of view, and relying on the difference between cash inflow and income, the most adequate variable for representing the capacity to generate internal resources is cash flow. Thus, the direct and significant relationship between profits and debt obtained by Barton et al. (1989) can be justified, given that instead of measuring the capacity to generate internal resources, it may be showing the capacity to deduct the interest on the debt.

The problems involved in sub-optimal investment policies are much more complex because we also have to consider the impact of cash flow on investment processes, as Jensen (1986) reflected in his free cash flow theory. Obviously, the existence of free cash flow can lead managers to carry out investment projects with a negative net present value. However, as Stulz (1990) established, there must be a trade-off between this over-investment problem and the under-investment problem, the latter posed by Myers and Majluf (1984) and Myers (1984) alleging the existence of asymmetric information. Under-investment gives rise to a problem of adverse selection for the investors who wish to acquire debt or shares. This circumstance may well lead the firm not to carry out investment projects with a positive net present value. In this section, we do not pay special attention to the studies that introduce variables to measure free cash flow. The reason is because, from our point of view, they do not generally respect the original meaning of Jensen's definition as interaction of cash flow and investment opportunities. Therefore it is difficult to interpret them correctly as explanatory variables of capital structure.[1]

2.1.3. Some aspects of capital structure relevant to financial distress

One characteristic of debt, not yet mentioned, refers to the fact that it involves the realization of periodic payments. For this reason, we should introduce a variable that includes financial distress costs. It has been supposed that firms having greater business risk tend to have low debt ratios, as shown by Prowse (1990), Homaifar et al. (1994) and Bathala et al. (1994). However, there are authors who do not achieve significant results, i.e. Barton et al. (1989), Jensen et al. (1992) and John (1993). Finally, MacKie-Mason (1990) introduces various measures, which produce contradictory results. All these studies take the volatility of operating income, estimated as the standard deviation of earnings before interest and taxes (EBIT), as a measure of business risk. In our opinion, this variable should be adjusted for the expected value of EBIT. Furthermore, when evaluating the financial distress costs, apart from considering a measure of the probability of this occurring, one must consider another measure which incorporates the magnitude of the costs, which would be incurred if insolvency occurred, e.g. an index of asset specificity.

2.1.4. Aspects related to the interdependence between investment and debt

Finally, the stance held by Modigliani and Miller (1958) on the independence of investment and financing decisions gave rise to theories that embrace the aspects commented on in the previous three points. These aspects are those that allow the transition from independence to interdependence between investment and financing decisions. Thus, the empirical study carried out by Azofra and Miguel (1990), utilizing a simultaneous system of equations as the estimation procedure, obtains a direct relationship between investment and debt. This could mean that firms look for and obtain funds

[1] In Section 3, we come back to this subject, proposing an alternative variable.

when they have to finance investment projects and also, that carrying out those projects helps a firm's access to financing, since there is an increase in the guarantees that contribute to the fulfillment of financial obligations.

2.2. Institutional characteristics related to capital structure

The aspects that we have previously indicated as determinants of capital structure have been extended by papers that take advantage of cross-country comparisons. In this respect, we can highlight the work of Rajan and Zingales (1995) (hereafter, RZ) whose first objective was to study whether the capital structure in the G-7 countries other than the US is related to factors similar to those appearing to influence the capital structure of US firms. Although firms have a fairly similar capital structure across the G-7 countries, they find several differences. In a more descriptive paper on differences in capital structure between the G-7 countries, Mcclure et al. (1999) obtain empirical results that support significant differences. In another recent paper, Wald (1999) investigates the firm characteristics that affect capital structure in France, Germany, Japan, UK, and US. As in RZ, he obtains similar firm factors across countries, but also some significant differences. The explanation of these differences, according to Wald (1999), is that institutional features may be significant determinants of capital structure.

An analysis of the major institutional differences across G-7 countries has been provided by RZ. They argue that the institutional characteristics that affect capital structure are: tax code, bankruptcy laws, state of development of bond markets and patterns of ownership. In line with the analysis of RZ, we discuss these institutional characteristics for Spain in order to highlight the major institutional differences between the US and Spain. In addition, we analyze their likely impact on capital structure, since we will use these major differences to explain the distinct effect that firm characteristics have on capital structure depending on the country.

The analysis of Spanish institutional characteristics is necessarily related to Saá-Requejo (1996), but according to RZ, we pay special attention to institutional characteristics related to the asymmetric information and agency problems. Furthermore, due to its nature, the interdependence between investment and debt is not affected by institutional characteristics, consequently we do not analyze this aspect in this section.

2.2.1. Institutional characteristics related to tax aspects

Selected features of the Spanish income tax code are described in Saá-Requejo's (1996) appendix. There is an important difference between the Spanish and the US tax code, since Spanish firms have more NDTS. The Spanish tax code provides for several types of investment tax credits and there are significant tax incentives for hiring additional workers. This idea is confirmed by the empirical evidence obtained by Demirgüç-Kunt and Maksimovic (1996). Their results show two different extremes for NDTS in G-7 countries, on the one hand, US, Japan and Canada have few NDTS, and on the other, European countries have more of them. According to Demirgüç-Kunt and Maksimovic (1996), Spain has even more NDTS than the aforementioned European

countries. Therefore, we can conclude that Spanish NDTS are substantially greater than those of the US. In consequence, the variable NDTS should present a significant inverse relationship in our study, contrary to the non-significant results obtained in several studies using data of US firms, as previously indicated.

2.2.2. Institutional characteristics related to asymmetric information and agency problems

RZ do not find any systematic differences between the level of leverage in the so-called bank-oriented countries (Japan, Germany, France and Italy; Spain could also be included in this group) and in the so-called market-oriented countries (US, UK and Canada). They argue that the difference between bank-oriented and market-oriented countries is reflected in the choice between public and private financing. However, they do not analyze the impact of this choice on those asymmetric information and agency problems related to capital structure.

From our point of view, there are two important aspects to take into account. First, the use of private debt instead of public debt. If we analyze the ratio of Bond market capitalization to Gross domestic product, as reported in RZ, we can observe that there are two different extremes: the US, whose bond market is well developed, and Germany and Italy, whose bond markets are inadequately developed. Like the latter, Spain has an inadequately developed bond market. For instance, the public debt ratio, defined as the percentage of debt held in publicly traded instruments (see Cantillo and Wright, 2000) took the value of 0.1012 for Spanish firms at the end of 1992, while at the same time, according to Cantillo and Wright (2000), the public debt ratio took the value of 0.2941 for US firms. Therefore, Spanish firms have less public debt than US firms. There is no doubt that public debt has higher transaction costs than private debt, and consequently, Spanish firms could adjust their actual debt level to the target debt level better than US firms.

Furthermore, the use of private debt lessens the agency costs of debt. With regard to the subject under discussion, the results obtained by Krishnawami et al. (1999) support the view that the higher use of private debt mitigates the moral hazard problems described in Section 2.1.2. This is because of the advantage private lenders have in writing and enforcing bond covenants, and the greater incentives they have for monitoring; the latter is due to the small number of lenders and the higher average default risk. The adverse selection problem described in Section 2.1.2 can also be mitigated by using privately placed debt, since private lenders may have superior firm-specific information, as supported by Best and Zhang (1993). That is, private lenders have access to non-public information, and therefore there is less information asymmetry between firms and lenders. As a consequence, if private debt lessens the agency costs of debt, firms with more private debt will have less reliance on cash flow. However, firms that use public debt have the advantage of access to the bond market. Thus, they can mitigate their financing constraints, and should therefore have relatively less sensitivity to fluctuations in internal resources. Hence, when the bond market is inadequately developed, as in the Spanish case, it is of interest to study which type of debt has more advantages.

A second major aspect is the impact of patterns of ownership on the free cash flow problem. There are two well-differentiated patterns of ownership (see for example RZ and Gedajlovic and Shapiro, 1998): on one hand, the Anglo-American pattern where firms have diffused ownership and on the other, the Continental European pattern where firms have highly concentrated ownership. Therefore, we must discuss how this affects the free cash flow problem. The existence of asymmetric information can lead to divergence between interests of shareholders and managers. Thus, the manager may use the free cash flow to carry out investment projects with a negative net present value instead of repaying these funds to the shareholders. If the ownership is highly concentrated, the shareholders are more encouraged to control the managers in order to prevent them from carrying out investment projects with a negative net present value. As a consequence, firms with a high level of ownership concentration will have a minor free cash flow problem and should therefore issue less debt to mitigate this problem.

2.2.3. Institutional characteristics related to financial distress

In their study RZ suggest that bankruptcy procedures vary considerably across G-7 countries. In a previous paper, Franks and Torous (1993) conclude that the UK and the US bankruptcy codes have a major difference: the US code appears to have strong incentives to keep the firm as a going concern; in contrast, the UK code emphasizes the rights of creditors and this likely leads to premature liquidations. Agreeing with these authors, RZ state that there are two extremes: the US at one end and the UK or Germany at the other. On one hand, the US bankruptcy code gives management substantial rights, such as the right to run the firm during the proceedings. On the other hand, in Germany, for instance, the management is replaced by a receiver during the proceedings. Franks et al. (1996) compare the efficiency of US, UK and German insolvency codes, and they obtain similar conclusions according to the two extremes. The Spanish situation is closer to the second extreme, like the UK and Germany. Spanish bankruptcy law replaces the management with a pool of the main creditors, which, as Saá-Requejo (1996) argues, reduces the bargaining power of management in negotiating the reorganization plan with creditors. However, in this case, more research is necessary before we can predict that financial distress costs have a different impact on the capital structure of Spanish and US firms.

3. Explanatory model of capital structure

Taking as a starting point, the state of the art described in Section 2, we are going to establish the empirical design of our research, which will enable us to test some of the theories that offer an explanation of capital structure and how some institutional characteristics affect it. In order to do so, let us briefly explain the variables[2] used and

[2] An exact definition of all the variables can been found in Appendix A.

the expected relationships, so that we can then move on to the econometric specification of the model.

3.1. The variables and the expected relationships

The dependent variable is the debt ratio[3], D_{it}, which is defined as the ratio between the market value of long term debt and the market value of equity plus the market value of long term debt.[4]

In order to consider the tax aspects that influence capital structure, the key variable is non-debt tax shields. Although this variable includes various elements, as reflected in Section 2, its disintegration is not possible. This is because one of these elements is investment tax credits correlated to investment. Therefore, we have opted, as have other studies on the determinants of capital structure, for Titman and Wessels (1988) proposal introducing the non-debt tax shields variable, NDTS_{it}. This is calculated as the earnings before taxes minus the ratio between the taxes paid and the tax rate. Consequently, the variable includes those quantities of earnings that were not taxed because the firms had non-debt tax shields. Therefore they are presented as a substitute for debt in order to reduce the tax burden, as a result the expected relationship for Spanish firms between NTDS and debt level should be inverse.

In order to evaluate the financial distress costs, FDC_{it}, we constructed a variable which includes two components. A measure of the probability of occurrence, calculated as the difference between the standard deviation and the expected value of EBIT; and a measure of asset specificity, i.e. the intangible assets whose value would be lost if the firm declared bankruptcy.[5] If we add up both variables, we get a new one, which can be interpreted as follows. Lenders perceive financial distress costs to be higher when the difference between the standard deviation and the expected value of EBIT increases. Their perception of financial distress costs will be greater or smaller depending on the intangible assets of the firm. That is why standard deviation should be adjusted for the expected value because, although the volatility of EBIT is very high, if the expected value of the aforementioned earnings is positive, lenders will not perceive the financial distress costs as high. However, if the expected value is negative, even though there is little volatility, lenders will then perceive the financial distress costs as high. In addition, lenders will take into account the level of intangible assets of the firms, since these assets are very specific and would lose their value in case of bankruptcy. Therefore, the described variable is negatively related to debt.

Investment, I_{it}, is calculated, according to the proposal by Lewellen and Badrinath (1997) (see Appendix A), as the difference between the net fixed assets of the current

[3] The first sub-index of the variables will refer to individuals, in this case firms, and the second to time, in this paper, a business year.

[4] Even though some approximation is made in the calculating process of the market value of debt, this will always be preferable to the book value of debt; see Sweeney et al. (1997).

[5] Saá-Requejo (1996) takes into account these two measures although he does not adjust the first one for the expected value.

and previous periods, adding the depreciation expenses corresponding to the current period. In this case, a positive coefficient for investment is expected, based on the interdependence between investment and financing decisions.

Cash flow, CF_{it}, is calculated as EBIT plus all non-cash deductions from earnings, which in our case are depreciation expenses and provisions. As was explained in Section 2, the asymmetric information gives rise to cash flow having priority over debt as a source of finance so as to avoid the under-investment problem, therefore the expected relationship between cash flow and debt in the presence of asymmetric information is inverse.

In order to test the free cash flow theory formulated by Jensen (1986), according to which there must be cash flow which is not consumed by investment opportunities, we introduce a variable called free cash flow, FCF_{it}, defined as the interaction between cash flow and the inverse of investment opportunities.[6] Various solutions have arisen to avoid allocating free cash flow to projects with a negative net present value, amongst which, the issue of debt and the payment of dividends are worth noting. If most firms use debt to eliminate the free cash flow problem, the relationship between debt and free cash flow will be direct.

All the variables are scaled by the replacement value of capital, K_{it}, measured as the replacement value of fixed assets plus the replacement value of inventories plus the book value of the rest of the assets.

Finally, we also consider some variables so as to study the impact of institutional characteristics in the aforementioned relationships. First, following Cantillo and Wright (2000), we define the public debt ratio, m_{it}, as the percentage of long term debt held in publicly traded instruments. Second, according to Agrawal and Knoeber (1996), we define the ownership concentration, OC_{it}, as the percentage of shares held by owners of 5% or more of the equity. Third, we have constructed a variable meant to capture the existence of asymmetric information. In Section 2.1.2, we have explained why investors can use firms' assets as a measure of the level of asymmetric information in the firm. The existence of intangible assets indicates significant problems of asymmetric information, while the existence of tangible assets reveals minor problems of asymmetric information. In order to summarize this information, we have carried out a factor analysis with principal components using the variables tangible fixed assets and intangible fixed assets; in both cases, these variables are scaled by the replacement value of capital. The coordinates of these variables on the first factorial axis are 0.7078 and -0.7078 for tangible fixed assets and intangible fixed assets, respectively, the eigen value being 1.0020. Therefore, we have constructed a factor, FIA_{it}, which is positive for firms with relatively high tangible fixed assets and relatively low intangible fixed assets. The firms in this group will face minor asymmetric information problems. On the contrary, firms will face greater problems when the factor is negative.

[6] Investment opportunities are incorporated by using Tobin's q, which reflects the ratio between the firm's market value and its replacement value of capital.

3.2. Econometric specification of the model

As we explained in Section 3.1, the target debt level for a firm, D_{it}^{*}, depends on cash flow, investment, non-debt tax shields and financial distress costs. This can be expressed as

$$D_{it}^{*} = \beta_1 + \beta_2\left(\frac{\text{NTDS}}{K}\right)_{it} + \beta_3\left(\frac{\text{FDC}}{K}\right)_{it} + \beta_4\left(\frac{I}{K}\right)_{it} + \beta_5\left(\frac{\text{CF}}{K}\right)_{it} + \upsilon_{it}. \quad (1)$$

When considering the existence of transaction costs, firms do not automatically adjust their debt level but instead follow a target adjustment model[7], according to which

$$D_{it} - D_{it-1} = \alpha\left(D_{it}^{*} - D_{it-1}\right), 0 < \alpha < 1 \quad (2)$$

where D_{it} and D_{it-1} are the actual debt levels in the current and previous period, respectively, and D_{it}^{*} is the firm's target debt, ignoring the costs of transaction to a new debt level.

Transaction costs are measured by the coefficient α. In this way, the economic interpretation of Eq. (2) is: if transaction costs are zero, i.e. $\alpha = 1$, then $D_{it} = D_{it}^{*}$ and the firms automatically adjust their debt level to the target debt level triggered by the absence of transaction costs. On the contrary, if $\alpha = 0$ then $D_{it} = D_{it-1}$, which implies that transaction costs are so high that no firm adjusts its debt level, thus remaining in the debt level of the previous period. In intermediate situations where values of α between 0 and 1, firms adjust their debt level in a way that is inversely proportional to the transaction costs.

From Eq. (2), we can find the actual debt level

$$D_{it} = \alpha D_{it}^{*} + (1-\alpha) D_{it-1}. \quad (3)$$

Lastly, incorporating Eq. (1) into Eq. (3) and bearing in mind that the estimations were carried out with panel data, we get

$$D_{it} = \alpha\beta_1 + (1-\alpha) D_{i,t-1} + \alpha\beta_2\left(\frac{\text{NDTS}}{K}\right)_{it} + \alpha\beta_3\left(\frac{\text{FDC}}{K}\right)_{it} + \alpha\beta_4\left(\frac{I}{K}\right)_{it} + \alpha\beta_5\left(\frac{\text{CF}}{K}\right)_{it} + d_t + \eta_i + \upsilon_{it} \quad (4)$$

where d_t is a time-specific effect, η_i is a firm-specific effect and υ_{it} is a white noise disturbance.

In other models of debt adjustments, the optimum debt level is externally determined either in terms of historical data or by an adjustment process with lags of more than one year (e.g. Jalilvand and Harris, 1984; Shyam-Sunder and Myers, 1999). However, in our model, the firms adjust to a target debt level, which is not determined externally as in the previous studies. Instead, this level is included in the model as a linear function of the determining factors of capital structure, as determined in Section 2.

[7] This model has also recently been used by Gilson (1997) for financially distressed firms.

4. Empirical evidence

4.1. Data base

In our econometric analysis, we have used panel data from non-financial quoted Spanish companies. The principal source of information is the data base from the CNMV (Spanish Security Exchange Commission). More specifically, we use data collected in the form of biannual information on all quoted companies (M.2.2) and biannual significant shares of all quoted companies (M.2.5). The market value of equity, extracted from the Stock Exchange Official Daily List, is also used.

Our data set covers all non-financial quoted Spanish companies from 1990 to 1997. Therefore, we have constructed an unbalanced panel comprising 133 companies for which the information is available for at least six consecutive years between 1990 and 1997. As a result, we have an unbalanced panel, whose structure by number of observations per company is given in Table 1. Although we have 1016 observations, the model will only be estimated for 883 of them, because it includes a lagged variable. Therefore, we lose the data for 1 year, which is also lost for the construction of the investment variable. Finally, Table 2 presents the companies in the sample allocated to 10 sub-sectors according to their main product and Table 3 provides summary statistics (mean, standard deviation, maximum and minimum) of the variables used in the estimation.

4.2. Results

The estimation of the dynamic model with predetermined variables has been carried out using a two-step Generalised Method of Moments (GMM). The first decision to be taken under this type of strategy is to determine what the valid instruments are for each equation of period t.

In principle, it seems clear that the model to be estimated may have problems of endogeneity in the regressors because, on one hand, the variables used can be determined simultaneously with the debt ratio—of which investment is a clear example. On the other hand, a delay may arise between the decision to change the capital structure and its actual execution, as far as the influence of the remainder of the explanatory variables is concerned. As a result, all the lagged values of the right-hand side variables

Table 1
Structure of the sample

Number of annual observations per company	Number of companies	Number of observations
8	102	816
7	14	98
6	17	102
Total	133	1016

Table 2
Sample distribution by sub-sector classification

Sub-sectors	Number of Companies	% Companies
Building	22	16.54
Chemical industry	8	6.01
Energy	14	10.52
Extractive industry	3	2.26
Food industry	21	15.8
Metal industry	8	6.01
Paper industry	6	4.51
Textile industry	3	2.26
Transport industry	14	10.52
Other	34	25.56

can be included in the instruments set, which also allows for the consideration of possible errors in measuring the variables. These lagged values are valid instruments because, in order to eliminate the firm-specific effects, we have transformed all variables by the orthogonal deviations proposed by Arellano and Bover (1995), using the following formula

$$x_{it}^{*} = \left[x_{i,t-1} - \frac{1}{T-t+1}\left(x_{it} + x_{i,t+1} + \ldots + x_{iT} \right) \right] \left[\frac{T-t+1}{T-t+2} \right]^{1/2} \quad (5)$$

for $t = 2,3,\ldots,T$, where T is the number of time periods. This transformation affirms that if $x_{i,t}$ is serially uncorrelated, then $x_{i,t-s}$ will be uncorrelated with x_{it}^{*} for $s \geq 2$. Therefore, if υ_{it} is uncorrelated, the transformed error term υ_{it}^{*} will have the same property and the right-hand side variables dated $t-s$ will be uncorrelated with υ_{it}^{*} for $s \geq 2$; then these variables are valid instruments. In our case, given that we have a reduced number of periods in relation to the number of individuals, in order to improve efficiency, we shall apply the strategy suggested by Arellano and Bond (1991) for these

Table 3
Summary statistic

	Mean	Standard deviation	Maximum	Minimum
D_{it}	0.0971	0.1006	0.5079	0.0000
$(\mathrm{NDTS}/K)_{it}$	0.0180	0.0500	0.4625	−0.0690
$(\mathrm{FDC}/K)_{it}$	0.0604	0.2065	3.4747	−0.2740
$(I/K)_{it}$	0.0392	0.1326	2.0841	−0.8208
$(\mathrm{CF}/K)_{it}$	0.0574	0.0770	0.3446	−0.2900
$(\mathrm{FCF}/K)_{it}$	0.0473	0.0802	0.9728	−0.5141
m_{it}	0.1083	0.2026	0.5285	0.0000
CO_{it}	0.6503	0.2349	1.0000	0.0000
IA_{it}	0.4179	0.4932	1.0000	0.0000

cases. This consists of taking all the right-hand side variables of the models lagged twice (or more) as valid instruments.

The estimation was carried out using the Dynamic Panel Data (DPD) program written by Arellano and Bond (1988). To check for potential misspecification of the models, we use the m_2 statistic, which tests for lack of second-order serial correlation in the first-difference residuals. In our paper, this hypothesis of second-order serial correlation is always rejected. However, because of the transformation, there is no lack of first-order serial correlation (m_1) in the differenced residuals, although the errors in the model in levels are not serially correlated. Finally, another test of specification used is Sargan's statistic of over-identifying restrictions, which tests for the absence of correlation between instruments and error term.

The results of the estimation of the model (4), based on the strategy explained above, appear in Column I of Table 4. Besides the aforementioned tests of specification, we present in Table 4 two Wald tests: the first (z_1) is a test of the joint significance of the reported coefficients, while the second (z_2) is a test of the joint significance of the time dummies. These results validate the target adjustment model for the capital structure decisions we have obtained. The significant results obtained for coefficient α indicate that firms bear transaction costs when they decide to adjust the debt level of the previous period to the target level in the current period. As can be deduced from Eq. (2), parameter α is inversely proportional to transaction costs, which is why these costs are not very high for Spanish firms. This conclusion can be explained by the lower level of development of the Spanish bond market, which has forced firms towards greater private debt. In fact, as indicated in Section 2.2.2, the public debt ratio for Spanish firms is lower than for US firms; that is, Spanish firms have less public debt than US firms. As there is no doubt that public debt has higher transaction costs than private debt, Spanish firms could adjust their actual debt level to the target level better than US firms. Therefore, the transaction costs borne by Spanish firms are inferior to those borne by US firms. For example, for US firms this parameter adopts values[8] between 0.304 and 0.410. In short, Spanish firms could better adjust their actual debt level because the Spanish bond market is less developed.

In addition to the evidence obtained for transaction costs, the results of our econometric analysis also corroborate all the expected relationships for the financial variables which our model incorporates, with significant coefficients in every case. Thus, for the non-debt tax shields variable an inverse relationship with debt is obtained. This result corroborates the tax theory, which considers non-debt tax shields as a substitute for debt to reduce firms' tax burden. It also shows that this variable has a higher explanatory power for Spanish firms than for US firms due to the fact that the former have more non-debt tax shields than the latter, as reported in Demirgüç-Kunt and Maksimovic (1996).

Financial distress costs are another variable which helps explain capital structure. In our model, the financial distress costs are negatively related to debt. Due to the

[8] The values obtained are: 0.383 (Jalilvand and Harris, 1984, Table II), 0.304 (Auerbach, 1985, Table 8.2) and 0.410 (Shyam-Sunder and Myers, 1999, Table 2).

Table 4
Estimation (133 companies, 883 observations; dependent variable: D_{it})

	I	II	III	IV	V	VI
D_{it-1}	0.2095* (0.0033)	0.2021* (0.0036)	0.2065* (0.0023)	0.2015* (0.0026)	0.2102* (0.0086)	0.2143* (0.0075)
$(\mathrm{NDTS}/K)_{it}$	−0.0909* (0.0301)	−0.0924* (0.0267)	−0.1047* (0.0219)	−0.1377* (0.0256)	−0.0987* (0.0348)	−0.1134* (0.0321)
$(\mathrm{FDC}/K)_{it}$	−0.0812* (0.0087)	−0.0745* (0.0085)	−0.0767* (0.0078)	0.0739* (0.0118)	−0.0796* (0.0212)	−0.0686* (0.0194)
$(I/K)_{it}$	0.0259* (0.0062)	0.0249* (0.0068)	0.0399* (0.0041)	0.0299* (0.0079)	0.0279* (0.0071)	0.0377* (0.0089)
$(\mathrm{CF}/K)_{it}$	−0.0573* (0.0208)	−0.0741* (0.0218)			−0.1395* (0.0387)	
$(\mathrm{FCF}/K)_{it}$			−0.0404* (0.0142)	−0.0675* (0.0223)		−0.0338* (0.0097)
$\mathrm{IA}_{it}(\mathrm{CF}/K)_{it}$		0.0931* (0.0299)				
$\mathrm{IA}_{it}(\mathrm{FCF}/K)_{it}$				0.1652* (0.0311)		
$\mathrm{Dm}_{it}(\mathrm{CF}/K)_{it}$					0.1003* (0.0275)	
$\mathrm{DOC}_{it}(\mathrm{FCF}/K)_{it}$						−0.0189* (0.0059)
z_1	249.83 (5)	298.44 (6)	272.19 (5)	388.19 (6)	285.36 (6)	352.25 (6)
z_2	111.48 (5)	169.01 (5)	170.32 (5)	217.26 (5)	168.21 (5)	160.78 (5)
m_1	−4.615	−4.556	−4.735	−4.979	−4.655	−5.296
m_2	−0.654	−0.941	−1.335	−1.268	−0.891	−0.812
Sargan	71.22 (66)	84.23 (80)	62.77 (66)	83.12 (80)	82.52 (80)	80.69 (80)

Notes: (i) Heteroskedasticity consistent asymptotic standard error in parentheses. (ii) * indicates significance at the 1% level. (iii) z_1 is a Wald test of the joint significance of the reported coefficients, asymptotically distributed as x^2 under the null of no relationship; z_2 is a Wald test of the joint significance of the time dummies; degrees of freedom in parentheses. (iv) m_i is a serial correlation test of order i using residuals in first differences, asymptotically distributed as $N(0,1)$ under the null of no serial correlation. (v) Sargan is a test of the over-identifying restrictions, asymptotically distributed as x^2 under the null, degrees of freedom in parentheses.

characteristics of the proxy constructed for these costs, the interpretation is that as investors perceive that there is a greater probability of bankruptcy and observe that the firms' assets are more specific, they demand a higher premium from the firm which discourages the use of debt in firms.

The estimation of the model shows a positive coefficient for investment. This confirms the simultaneity of investment and debt (well-known in the financial theory); firms look for funds when they have to finance investment projects and the investments undertaken favor the access that these firms have to financial markets by increasing the guarantees that they will fulfill their financial obligations.

Finally, the negative coefficient of cash flow confirms the expected inverse relationship between debt and cash flow. In this context, it can be inferred that those firms with the capacity to generate internal funds use these funds before falling back on debt; just as the pecking order theory postulates. The preference for the use of cash flow as opposed to debt is justified by the pecking order theory due to the asymmetric information that exists in financial markets, which leads lenders to demand a risk premium.

In order to confirm that the inverse relationship between cash flow and debt is due to the existence of asymmetric information, we observe any possible change in this relationship in both cases: when asymmetric information exists and when it does not. Thus, we will be able to corroborate the pecking order theory. For this test, we use the factor constructed in Section 3.1. It is meant to capture the asymmetric information, and allows us to classify the sample in order to analyze the role played by asymmetric information.

From this factor, we have constructed a dummy variable, AI_{it}, which takes the value of one when the factor is positive, the firm consequently facing minor problems of asymmetric information, and takes the value of zero when the factor is negative, and hence firms will face greater asymmetric information problems. This variable has been interacted with cash flow in order to analyze the sensitivity of debt to fluctuations in cash flow depending on the existence of asymmetric information. The new model to estimate would be

$$D_{it} = \alpha\beta_1 + (1-\alpha)D_{i,t-1} + \alpha\beta_2\left(\frac{\mathrm{NDTS}}{K}\right)_{it} + \alpha\beta_3\left(\frac{\mathrm{FDC}}{K}\right)_{it} + \alpha\beta_4\left(\frac{I}{K}\right)_{it} + \alpha(\beta_5 + \beta_6\mathrm{AI}_{it})\left(\frac{\mathrm{CF}}{K}\right)_{it} + d_t + \eta_i + \upsilon_{it} \quad (6)$$

where β_5 would be the coefficient for firms facing major problems of asymmetric information, since $\mathrm{IA}_{it} = 0$ for these firms. $(\beta_5 + \beta_6)$ would be the coefficient for the firms facing minor problems of asymmetric information, since $\mathrm{IA}_{it} = 1$ for these firms. The results of the estimation of the model, following the strategy previously explained, are shown in Column II of Table 4. These results indicate that there is a significant difference in the relationship between cash flow and debt depending on the level of asymmetric information, because β_6 is positive and significant. Therefore, the coefficient that captures the relationship between cash flow and debt for firms facing major

problems of asymmetric information is negative (-0.0741), while for the rest of the firms this coefficient is positive $(-0.0741 + 0.0931 = 0.019)$.

On one hand, this test confirms that the negative relationship between cash flow and debt originates in the existence of asymmetric information, corroborating the postulate of the pecking order theory. On the other hand, in the absence of asymmetric information, the relationship between cash flow and debt is positive. We can conclude that in this scenario, instead of worrying about under-investment problems, firms take action to avoid the opposite problem, i.e. over-investment, according to the trade-off between under- and over-investment, as considered by Stulz (1990). This latter problem is explained by the free cash flow theory formulated by Jensen (1986). When a firm worries about the over-investment problem, one possible solution is the issue of debt in order to avoid investment projects being carried out with a negative net present value. In this context, if this solution is generally used, then there should be a direct relationship between debt and free cash flow.

To test this hypothesis, we introduced the free cash flow variable into model (4) instead of the cash flow variable. The results of the estimation of this model are shown in Column III of Table 4. However, these results do not confirm the expected positive relationship between free cash flow and debt, which indicates that in general Spanish firms do not resolve the free cash flow problem by issuing debt. The firms' decision not to issue debt can be explained by the existence of asymmetric information, which leads debt holders to demand a higher risk premium, creating a problem of under-investment. This leads firms to look for a trade-off between under- and over-investment problems. To test this hypothesis, we estimated a model which includes the free cash flow variable and the dummy variable previously defined to take into account the asymmetric information.

The results obtained in the new estimation can be found in Column IV of Table 4. These results indicate that when there is asymmetric information, firms do not resolve the free cash flow problem by issuing debt, as the coefficient -0.0675 suggests, while in the absence of asymmetric information firms issue debt when they have free cash flow, as the coefficient 0.0977 $(-0.0675 + 0.1652)$ shows. This coefficient is much higher than the cash flow coefficient, which shows that in this scenario, when firms have cash flow and low investment opportunities they are more motivated to issue debt than when they only have cash flow, ignoring their investment opportunities.

As we explained in Section 2.2.2, private debt has the advantage of lessening the agency costs of debt, in contrast public debt has the advantage of mitigating the financing constraints. If the second advantage was more important, the firms with higher public debt ratio should have less reliance on cash flow. In order to test this hypothesis, we define a dummy variable, Dm_{it}, equal to 1 for firms that have a public debt ratio higher than the mean, and 0 otherwise. This dummy variable has been interacted with cash flow in order to estimate the potential sensitivity of debt to fluctuations in internal resources depending on the public debt ratio. The new model is similar to that of Eq. (6), although the dummy variable Dm_{it} replaces IA_{it}. The results (see column V of Table 4) indicate that debt is more sensitive to cash flow for firms whose public debt ratio is smaller than the mean, since β_6 is positive and significant. To be exact, the coefficient

for these firms is −0.1395, while the coefficient for firms with a higher public debt ratio is −0.0392 (−0.1395 + 0.1003).

In light of our evidence, it would appear that in countries where the bond market is inadequately developed, the advantage provided by private debt, which lessens the agency costs of debt, is not as great as the advantage provided by access to the bond market. In the last case, firms can mitigate the financing constraints, and therefore, debt is less sensitive to fluctuations in internal resources. In this sense, the behavior of Spanish firms is different from that of US firms. In addition, the differences in the two countries in the public debt ratio of firms that have access to the bond market can contribute to a suitable explanation for this behavior. Spanish firms always combine both private and public debt (the maximum for m_{it} in Table 3 is 0.5285), which allows them to take advantage of the benefits of private debt. This argument agrees with the results of Datta et al. (2000), who show that if private debt exists before public debt is issued, the former reduces the agency costs of the latter.

Finally, we study how ownership concentration mitigates the free cash flow problem. With this aim, we have introduced the dummy variable DOC_{it} instead of IA_{it} into the penultimate model estimated. DOC_{it} is a dummy variable, which takes the value of 1 when the level of ownership concentration is higher than the mean, and takes the value of 0 in all other cases. The results obtained (see column VI of Table 4) show that if the ownership concentration is low the negative impact of free cash flow on debt is smaller (−0.0338) than in the case of highly concentrated ownership (−0.0522 = −0.0338 − 0.0189). This evidence is due to the fact that firms with highly concentrated ownership have greater incentive to control managers. Hence, these firms need to issue less debt in order to prevent managers from carrying out investment projects with a negative net present value.

5. Conclusions

In this paper, we have developed a target adjustment model to explain firm characteristics that determine capital structure and how institutional features affect capital structure. First, the estimation of the model using a sample of non-financial quoted Spanish firms corroborates the proposed model. These results show that firms bear transaction costs when they decide to adjust their debt level. In the case of Spanish firms, the transaction costs are lower than those of US firms, due to their higher percentage of private debt.

Secondly, the empirical evidence obtained from the estimation of the target adjustment model corroborates the following expected relationships: (i) an inverse relationship between non-debt tax shields and debt, which is more significant for Spanish firms because they have more non-debt tax shields than US firms; (ii) an inverse relationship between financial distress costs and debt, due to the higher premium demanded by debt underwriters; and (iii) a direct relationship between investment and debt, which confirms the simultaneity of both decisions.

Thirdly, the inverse relationship obtained between cash flow and debt indicates that cash flow is preferred to the use of debt as a source of financing. This preference

originates in an attempt to avoid under-investment when firms face major problems of asymmetric information. However, in the absence of asymmetric information, firms are more concerned with avoiding the problem of over-investment, where there is a direct relationship between cash flow and debt, since the latter is used to reduce the managers' incentive to carry out investment projects with negative net present value. Finally, firms look for a trade-off between under-investment and over-investment. These results provide some additional evidence in favor of the pecking order and free cash flow theories.

Fourthly, the greater sensitivity of debt to fluctuations in cash flow when the public debt ratio is high indicates that in countries like Spain, where the bond market is inadequately developed, the advantage provided by private debt (lower agency costs of debt) is not as great as that provided by access to the bond market (fewer financing constraints). Also, it is important to take into account another institutional characteristic, such as the level of ownership concentration, because a high level mitigates the free cash flow problem, and therefore firms with highly concentrated ownership need to issue less debt.

Finally, we have offered some evidence about firm characteristics that determine capital structure in a country different from the US, and we have analyzed how different institutional features affect capital structure for Spanish firms, but the latter is still unsettled in a cross-country context. It could be a line for future research.

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Appendix A

A.1. Debt ratio

$$D_{it} = \frac{\text{MVLTD}_{it}}{\text{MVLTD}_{it} + \text{MVE}_{it}} \tag{7}$$

where MVE_{it} is the market value of equity and MVLTD_{it} is the market value of the long term debt.

$$\text{MVLTD}_{it} = \left[\frac{1 + l_{it}}{1 + i_{l}}\right]\text{BVLTD}_{it} \tag{8}$$

where $BVLTD_{it}$ is the book value of the long term debt, i_l is the rate of interest of the long term debt reported in the Boletín Económico that is published by the Spanish Central Bank (Banco de España), and l_{it} is the average cost of long term debt that is defined as $l_{it} = (IPLTD_{it}/BVLTD_{it})$, where $IPLTD_{it}$ is the interest payable on the long term debt, which has been obtained by distributing the interest payable between the short and long term debt depending on the interest rates. That is

$$IPLTD_{it} = \frac{i_l BVLTD_{it}}{i_s BVSTD_{it} + i_l BVLTD_{it}} IP_{it} \tag{9}$$

where IP_{it} is the interest payable, i_s is the rate of interest of the short term debt, also reported in the Boletín Económico, and $BVSTD_{it}$ is the book value of the short term debt.

A.2. Non-debt tax shields

Let $EBIT_{it}$ be the earnings before interest and taxes, IP_{it} the interest payable, T_{it} the taxes paid, t the tax rate and $NDTS_{it}$ the non-debt tax shields. Then the taxes paid are calculated as $T_{it} = t(EBIT_{it} - IP_{it} - NDTS_{it})$ from where

$$NDTS_{it} = EBIT_{it} - IP_{it} - (T_{it}/t). \tag{10}$$

A.3. Financial distress costs

$$FDC_{it} = \left[\sigma(EBIT_{it}) - E(EBIT_{it})\right] + INA_{it} \tag{11}$$

where INA_{it} are the intangible assets.

A.4. Investment

Let FA_{it} be the gross book value of the tangible fixed assets of the period t, R_{it} the gross book value of the old assets retired during the year t, AD_{it} the accumulated book depreciation for the year t and D_{it} the book depreciation expense corresponding to year t. Then, we have the following equalities

$$FA_{it} = FA_{it-1} + I_{it} - R_{it} \tag{12}$$

$$AD_{it} = AD_{it-1} + D_{it} - R_{it}. \tag{13}$$

If we solve Eq. (13) for R_{it} and incorporate it into Eq. (12) we obtain

$$FA_{it} = FA_{it-1} + I_{it} + AD_{it} - AD_{it-1} - D_{it}. \tag{14}$$

If we realign terms the expression is transformed into

$$FA_{it} - AD_{it} = FA_{it-1} - AD_{it-1} + I_{it} - D_{it}. \tag{15}$$

As $FA_{it} - AD_{it} = NF_{it}$, i.e. the net fixed assets, the former equation can be rewritten more compactly as

$$NF_{it} = NF_{it-1} + I_{it} - D_{it}. \tag{16}$$

From which, we find the value of the investment

$$I_{it} = \mathrm{NF}_{it} - \mathrm{NF}_{it-1} + D_{it}. \tag{17}$$

A.5. Cash flow

$$\mathrm{CF}_{it} = \mathrm{EBIT}_{it} + D_{it} + P_{it} \tag{18}$$

where P_{it} are the different provisions reported in the profit and loss account.

A.6. Replacement value of capital

$$K_{it} = \mathrm{RF}_{it} + \mathrm{RI}_{it} + (\mathrm{TA}_{it} - \mathrm{BF}_{it} - \mathrm{BI}_{it}) \tag{19}$$

where RF_{it} is the replacement value of tangible fixed assets, RI_{it} is the replacement value of inventories, TA_{it} is the book value of total assets, BF_{it} is the book value of tangible fixed assets and BI_{it} is the book value of inventories. The latter three have been obtained from the firm's balance sheet and the first two have been calculated according to the proposals by Perfect and Wiles (1994).

$$\mathrm{RF}_{it} = \mathrm{RF}_{it-1}\left[\frac{1+\phi_t}{1+\delta_{it}}\right] + I_{it} \tag{20}$$

for $t > t_0$ and $\mathrm{RF}_{it_0} = \mathrm{BF}_{it_0}$, where t_0 is the first year of the chosen period, in our case 1990. On the other hand $\delta_{it} = D_{it}/\mathrm{BF}_{it}$ and $\phi_t = (\mathrm{IPRI}_t - \mathrm{IPRI}_{t-1})/\mathrm{IPRI}_{t-1}$, where IPRI_t is the growth of capital goods prices reported in the Boletín Mensual de Estadística that is published by the Instituto Nacional de Estadística of Spain.

$$\mathrm{RI}_{it} = \mathrm{BI}_{it}\left[\frac{2P_{it}}{P_{it} + P_{it-1}}\right] \tag{21}$$

where P_{it} is the wholesale index, which is also reported in the Boletín Mensual de Estadística.

A.7. Tobin's q

$$q_{it} = \frac{\mathrm{MVE}_{it} + \mathrm{MVD}_{it}}{K_{it}} \tag{22}$$

where $\mathrm{MVD}_{it} = \mathrm{MVLTD}_{it} + \mathrm{BVSTD}_{it}$ is the market value of debt.

A.8. Free cash flow

$$\mathrm{FCF}_{it} = \mathrm{CF}_{it}(1/q_{it}). \tag{23}$$

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