Adjustment Costs and the Realization of Target Leverage of Spanish Public Firms *

Costes de ajuste y la consecución del objetivo de endeudamiento en las empresas cotizadas españolas

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ABSTRACT We analyze the relevance of adjustment costs in keeping Spanish public firms away from their target leverage. We argue that firm's cash flow outcomes determine the importance of the adjustment costs on capital structure changes. Then, we estimate capital structure adjustment speeds across three different cash flow realizations. We report that during years in which either over-levered or under-levered Spanish public firms make changes in their financing decisions, as a result of their high cash flow realizations, they close significantly more of the gap between current and target capital structure than those firms with intermediate and low cash flow observations. Moreover, independently of the cash flow level, we find that leverage adjusts more quickly for over-levered than for under-levered firms.

KEYWORDS Speed of Adjustment; Target leverage; Financial constraints; Adjustment costs.

RESUMEN En el trabajo se analiza la relevancia de los costes de ajuste por tener a las firmas cotizadas fuera de su endeudamiento objetivo. Se argumenta que el montante flujos de efectivo obtenidos determina la importancia de los costes de ajuste correspondientes a los cambios en la estructura de capital. A continuación se estiman las velocidades de ajuste en la estructura de capital para tres diferentes medidas de consecución de flujos de efectivo. En los años en que las firmas sub o sobreendeudadas, tras haber conseguido flujos de efectivo de importante cuantía, toman sus decisiones financieras, logran una reducción significativamente mayor de la diferencia entre la estructura de endeudamiento real y la objetivo que las firmas con cuantías intermedias o bajas de flujos de efectivo generados. Además, independientemente del valor de esos flujos de efectivo, todas las firmas sobreendeudadas ajustan su endeudamiento más rápidamente que las subendedudadas.

PALABRAS CLAVE Velocidad de ajuste; Endeudamiento objetivo; Restricciones financieras; Costes de ajuste.

* **Acknowledgments:** The authors acknowledge financial support from MEC research grant ECO2008-03058/ECON and CEU-UCH/Banco Santander Copernicus Program 4/2011. Gonzalo Rubio also acknowledges support from GV PROMETEO/2008/106. The authors are grateful from comments from Pablo de Andrés, José López-Gracia, Eleuterio Vallelado and Luis Vicente.
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1. INTRODUCTION

It is well known that, under the trade-off theory of capital structure, the tax benefits and the expected financial distress costs determine an optimal target capital structure. Hence, the basic strategy of recent research consists of testing whether a target leverage ratio exists. More specifically, recent literature focuses in analyzing how and when firms dynamically adjust their capital structure. If firms' capital structure adjustments are lumpy, dynamic partial adjustment models should capture the behaviour of firms regarding their financing decisions. It is therefore not surprising that academic research on the speed of adjustment toward target leverage has recently become a popular topic.

Two key papers initiate a new series of documents studying the leverage speed of adjustment. First of all, Flannery and Rangan (2006), in a very influential paper and relying on an instrumental variable in their mean differencing estimation, report a relatively fast speed of adjustment of 35.5 percent per year, which suggests that approximately one-third of the gap between current and target debt ratios is closed each year [(1)]. Secondly, Lemmon, Roberts, and Zender (2008) report a 25 percent speed of adjustment and argue that, although observed leverage is consistent with the existence of a target debt ratio, since firms seem to trade off the costs and benefits of leverage, their lagged (up to 15 years) debt ratios are highly significant determinants of their current capital structure.

Interestingly, however, this empirical evidence about how quickly firms move toward their target debt ratios is controversial. Indeed, there is an exciting debate on the trade-off theory of capital structure surrounding the use of the speed of adjustment toward target leverage. Chang and Dasgupta (2009) and Iliev and Welch (2010) argue that the empirical evidence in favor of target behavior and dynamic rebalancing of leverage may be caused by mechanical mean reversion. In particular, Chang and Dasgupta (2009) suggest that the existing tests of target behavior have no statistical power to reject alternative hypotheses. They show that simulated data in which firms choose randomly between debt and equity to finance their deficits generates speed of adjustments of similar magnitude to those found in the literature. Iliev and Welch (2010) argue that the estimated speed of adjustment reported in the literature suffer from the mis-specification of the dynamic process for leverage assumed by the partial adjustment model. Moreover, Hovakimian and Li (2010b) also show that the standard interpretation of partial-adjustment coefficients as economically meaningful measures of the relevance of target leverage is misleading [(2)]. Their results suggest that a significant fraction of corporate financing transactions generate leverage ratios that are not statistically close to the target. Therefore, it seems to be hard to interpret any speed of adjustment as evidence of a particular rebalancing behavior associated with the trade-off theory of capital structure.

(1) Antoniou, Guney, and Paudyal (2008) report a similar coefficient of 32.2 percent for the U.S. companies, although they report a range from 11.1 to 39.4 percent for Japan and France respectively. Additionally, Halling, Yu, and Zechner (2011) show that the speed of adjustment estimates are lower during recessions than during expansions.
(2) See also Hovakimian and Li (2010a). They point out that target debt ratios may change over time as a consequence of economic shocks and, therefore, the estimates of the adjustment speed could be biased.

These critiques of the speed of adjustment research, together with the generally accepted result that the speed with which target leverage is reached appears to be unexpectedly low, have motivated a recent line of research that takes explicitly into account asymmetries both on the relative amount of leverage and adjustment costs when firms move toward target market debt ratios (3). The bottom line of these new papers is that the adjustment speed depends on firm characteristics. The underlying idea is that any potentially sensible research about the speed of adjustment should be conditioned on these characteristics to increase the statistical power of the tests. Along these lines, as discussed by Graham and Leary (2011), there are two dynamic trade-off models that have received recent attention: the costly adjustment model based on the seminal paper of Fisher, Heinkel, and Zechner (1989), and the endogenous investment model of DeAngelo, DeAngelo and Whited (2011) in which partial adjustments also occur when firms choose the financing of new investments (4).

Fisher, Heinkel, and Zechner (1989) argue that firms adjust debt-equity ratios only if the benefits of making the adjustment more than offset the cost of eliminating the firm's deviation from target leverage. Indeed, Leary and Roberts (2005) find that the issuance and repurchase of securities by industrial firms is clustered in time, evidence consistent with the importance of adjustment costs (5). Moreover, Korajczyk and Levy (2003) show that the response of firms to cyclical fluctuations depends upon the stringency of financing constraints, and Byoun (2008) introduces adverse selection costs to conclude that firms move toward target debt ratios when they have above-target (below-target) debt with a financial surplus (deficit). More recently, Faulkender, Flannery, Hankins, and Smith (2012) point out that, under adjustment costs, a firm's cash flow needs can substantially impact the cost of making a leverage adjustment. In particular, they argue that over-levered firms with large positive cash flows or under-levered companies with funding deficits should tend to make large capital structure adjustments. Their results tend to confirm that the level of cash flow realizations conditioning on the leverage degree has a significant impact on the speed of adjustment.

On top of that, the recently available international evidence about the speed of adjustment with and without transaction costs makes difficult the overall evaluation of the results. In particular, Öztekin and Flannery (2011) show that firms in the common law countries adjust to optimal structure with an average rate of 9% to 14% (depending upon the econometric methodology employed) faster than civil law originated countries. They argue that market based economies entail lower market frictions. However, Dang, Garret, and Nguyen (2011) show that French and German firms present higher speed of adjustments than companies from either the U.S. or the United Kingdom. We argue that further international evidence should be provided studying in detail individual markets rather than presenting overall results or limited individual comparisons (6). The objective of this paper is to cover partly

(3) These studies ignore debt holder/equity holder agency problems that reduce incentives to move towards the target. See for instance Titman and Tsyplakov (2007).

(4) These authors show that the slow adjustment speed reported in literature can be explained if we recognize not only the tax benefits and distress costs of financing decisions, but also the option to finance future investments when encountered limited debt capacity.

(5) See also Strebulaev (2007).

(6) See Dang, Kim, and Shin (2011) for an exception using U.K. data from 1996 to 2003.

this gap by identifying cross-sectional variation in adjustment costs for Spanish public firms and test whether such transaction costs, and also to be either above-target or below-target leverage, are correlated with the speed of adjustment toward target leverage. Evidently, our evidence should be interpreted as coming from an important representative example of a civil law country.

Regarding the empirical evidence with Spanish public data, Rubio and Sogorb (2011), using new econometric techniques, show that the speed of adjustment for the typical Spanish firm is 17.5 percent, which indicates that approximately only one-fifth of the gap is closed each year. However, it is very important to recognize that they do not allow for asymmetric and costly capital structure adjustment. This is an important limitation of their analysis. In contrast, in this paper we estimate capital structure adjustment speeds across different cash flows realizations and alternative over-levered or under-levered positions to take into account differential adjustment costs. Our results show that the estimated speed of adjustment is a decreasing function of estimated adjustment costs approximated by the inverse of cash flow realizations. The estimated speed of adjustment varies from 51.6 (or from 69.1) percent for over-levered firms with high cash flows realizations to 27.8 (or to 27.7) percent for under-levered firms with low cash flows depending upon the panel data estimator employed. Using an ample variety of econometric techniques, we find the same pattern within a given over- or under-levered category [(7)]. Thus, independently of being over- or under-levered, firms with high clash flows seem to move faster toward target leverage than the rest of firms. This seems to suggest a strong relationship between adjustment costs and the speed of adjustment toward target leverage in Spain. It indicates that, once Spanish firms have enough resources to compensate the costs of reducing the firm's deviation from target leverage, they quickly move toward their target debt-equity ratio.

The remainder of the paper is organized as follows. Section 2 describes briefly the partial adjustment model with transaction and financing costs. Section 3 discusses firms' characteristic target determinants, while Section 4 presents our data and summary statistics. Section 5 discusses some important econometric issues and reports estimates of the speed of adjustment to target leverage obtained under two distinct econometric procedures, and discuss the effects of adjustment costs and the over-levered or under-levered status. Section 6 analyzes the robustness of our results extending the basic panel analysis to a two-step econometric procedure with dummy variables and bootstrapped standard errors, while Section 7 presents the effects of recognizing active versus passive capital structure adjustments. Finally, Section 8 contains our conclusions.

2. THE PARTIAL-ADJUSTMENT MODEL OF FIRM CAPITAL STRUCTURE, OVER- AND UNDER-LEVERED POSITIONS, AND CASH FLOW REALIZATIONS

The market debt ratio is defined as:

(7) The only exception is reported for the over-levered firms when the speed of adjustment is estimated using the LSDVC estimator.

$$MDR_{jt} = \frac{D_{jt}}{D_{jt} + n_{jt}\ P_{jt}} \tag{1}$$

where D_{jt} is the book value of firm *j's* interest-bearing debt, n_{jt} equals the number of common shares outstanding, and P_{jt} denotes the price per share (8). The basic partial adjustment model of firm leverage proposed by Flannery and Rangan (2006) is given by:

$$MDR_{jt} - MDR_{jt-1} = \lambda\left(MDR_{jt}^{*} - MDR_{jt-1}\right) + u_{jt} \tag{2}$$

where λ is the adjustment speed toward target leverage, and the desired debt ratio is given by,

$$MDR_{jt}^{*} = \beta' X_{jt-1} \tag{3}$$

where MDR^{*}_{jt} is firm *j's* target market debt ratio at *t*, X_{jt-1} is a *K*-vector of firm characteristics, and β is a *K*-vector of coefficients such that the trade-off hypothesis implies that $\beta \neq 0$. Substituting *(3)* into *(2)*, we obtain the basic specification that allows an incomplete adjustment of a firm's initial capital structure toward its target within each time period:

$$MDR_{jt} = (\lambda\beta)'\ X_{jt-1} + (1-\lambda)MDR_{jt-1} + u_{jt} \tag{4}$$

If we estimate expression *(4)* as in Rubio and Sogorb (2011), we implicitly assume that Spanish firms could fully adjust to their target capital structure each year. The main argument of the present paper is that adjustment costs prevent firms for quickly achieving their target debt ratios. Indeed, Faulkender, Flannery, Hankins, and Smith (2012), approximate potential adjustment costs with cash flow levels, and estimate adjustment speeds in the range of 23 to 26 percent for firms with low or near zero cash flows. However, for firms with cash flows significantly higher or lower than zero, the adjustment speeds raise in excess of 50 percent. Additionally, as discussed by Korajczyk and Levy (2003), Faulkender and Petersen (2006), Byoun (2008), Dang, Kim, and Shin (2011), and Faulkender, Flannery, Hankins, and Smith (2012), adjustment could also be incomplete if we do not eliminate the symmetry between over- and under-levered firms. As in Byoun (2008), they also show that over-levered firms tend to have a much higher speed of adjustment relative to under-levered firms which suggests that over-levered firms have either greater benefits or lower costs of adjusting their target market debt ratios.

(8) The choice of scaling debt by the market value of equity or the book value of equity is not obvious. At least the first papers briefly discussed in the introduction tend to employ both possibilities when presenting the results. Their results are not sufficiently different to modify the economic conclusions. For this reason, and given that scaling by market values is theoretically sounder, in this paper we only report results based on the market value of equity.

We therefore start the analysis by breaking our sample into over- and under-levered firms using the median of the leverage ratio of the industry [9] for which the firms belong to [10]. Regardless of whether firms are over- or under-levered, we still want to study the differences in adjustment speeds based on the extent to which adjusting would generate an incremental cost. For this reason we classify over- and under-levered firms into three additional categories that depend on the level of the firms' cash flow. We define the firm's cash flow as:

$$CF_{jt} = EBIT_{jt}\left(1-T_{jt}\right)+Dep_{jt} - Int_{jt} \pm Capex_{jt} \pm \Delta NWC_{jt} \qquad (5)$$

where $EBIT_{jt}$ is operating income before interest and taxes for firm j in year t, T_{jt} is the corporate tax rate, Dep_{jt} is the depreciation expenses, Int_{jt} is the interest paid, $Capex_{jt}$ is the change in the value of capital expenditures from year $t-1$ to year t, and ΔNWC_{jt} is the change in net working capital from the year $t-1$ to year t [11].

Using this definition of a firm's cash flow, and for each year in the sample, we impose a cutoff level in order to classify a firm as a high, medium or low cash flow company. The results presented below will show adjustment speeds for the bottom and top 30 percent of the cash flow distribution relative to the middle 40 percent [12].

The objective of this paper is therefore to study if adjustment costs, using the level of the cash flow as an indicator of their relevance in taking financing decisions, may limit the extent to which firms optimally move their capital structure to achieve their target leverage. Hence, our empirical strategy is to estimate expression *(4)* for all six categories of firms exogenously classified into over-levered or under-levered firms with either, large, medium or low cash flow.

3. FIRM CHARACTERISTICS AND TARGET LEVERAGE

To characterize a target debt ratio, we use a set of firm indicators that have appeared regularly in previous empirical papers [13]. In our case, the following variables are used as control variables in equations *(3)* and *(4)*:

(9) We have also applied other alternative cutoff criterions such as the sample mean or focusing only in those economic sectors that are comprised of an acceptable number of firms, but our empirical results are not sensitive to such changes. These results are available upon request to the authors.

(10) The theoretical literature on the renegotiation of debt also suggests that conditioning on the firm being over-levered or under-levered is also important from the point of view of capital structure dynamics. See Mella-Barral (1999), Hege and Mella-Barral (2005), and Halling, Yu, and Zechner (2011).

(11) Alternatively, we may also calculate the cash-flow of each firm relative to the total value of assets of the firm. We check for a potential pattern between the level of cash flows and the total value of the assets that may distort our results if we do not adjust for the total book value of the assets. Since, we do not observe any systematic pattern and, in particular, our sample does not show a positive relationship between the level of cash flows and the level of total assets, our measure does not deflate the cash flow by the lagged book asset of the company.

(12) Alternative sorting levels that ensure a similar number of observations in each group gives very similar results. An interesting and different procedure may employ threshold maximum likelihood techniques to estimate simultaneously the speed of adjustments and the optimal cut-off points. However, this is beyond the scope of this paper.

(13) The financial characteristics chosen are very common in the previous related literature. They basically coincide with the financial variables employed by Flannery and Rangan (2006), except that we do not explicitly use research and develop-

- Profitability measured as earnings before interest and taxes over total assets (*ROA*). It is generally accepted that firms that have more profits tend to have lower leverage, given that high retained earnings reduce the need of external financing with debt. It could also be the case that firms limit the issue of debt to protect their competitive advantage producing these high operating profits.
- Market-to-book ratio (*MTB*). Firms that have a high market-to-book ratio tend to have lower leverage, since it is generally a sign of future growth opportunities.
- Effective tax rate, defined as taxes paid as a proportion of earnings before taxes (*ETR*). Firms with higher effective tax rates are (theoretically) expected to have more leverage to take advantage of the tax deductibility of interest payments. However, the empirical evidence has proved to be unclear.
- Non-debt tax shields calculated as depreciation expenses as a proportion of total assets (*NDTS*). Firms with more depreciation expenses may have less pressure to increase their debt to take advantage of the deductibility of interest payments.
- The natural logarithm of total assets (*SIZE*). Firms that are large tend to have higher leverage because they have fewer restrictions in their access to financial markets, lower cash flow volatility, and less financial distress.
- Fixed assets as a proportion of total assets, or tangibility (*TANG*). Firms functioning with greater tangible assets, which are potentially collateralized, tend to have higher debt capacity.
- Non-tangible fixed assets as a proportion of total assets (*NTANG*). Firms with more intangible assets, especially if associated with R&D expenses, tend to have lower debt to protect themselves from higher bankruptcy costs.
- Interests paid as a proportion of earnings before interests and taxes, or interest expense coverage (*IC*). This variable may capture financial distress, although it may just mechanically be positively related with higher amounts of debt.
- Median market debt-to-equity ratio of the company's industry (*IDR*). Firms in industries in which the median company has high debt tend to have higher leverage.

4. DATA

Our firm sample comprises 101 Spanish traded non-financial firms with incomplete information for the 13-year period between 1995 and 2007. Table 1 contains the firm distribution by industry and the specific weight of each firm sector over the total sample. Three sectors account for almost 75 percent of the total number of firms in the sample: manufacturing, mining, and quarrying; construction; and wholesale and retail trade, transportation, and accommodation.

ment *(R&D)* expenses as a proportion of total assets but, rather, employ non-tangible assets as a proportion of total assets. Relative to these, we also add the effective tax rate and interest expense coverage. The effective tax rate is used by Huang and Ritter (2009), and the interest expense coverage is included as a measure of financial distress. Our chosen financial variables are also similar to those used by De Miguel and Pindado (2001), although our variables are relatively more disaggregated. These variables have been previously employed by Rubio and Sogorb (2011) in their study on the adjustment speed to target leverage of Spanish public firms.

Table 1
Sample Characteristics

Distribution of Firms by Economic Sector			
	Economic Sectors	***Firms***	***Percentage***
Sector 1	Agriculture, forestry, and fishing	2	1.98
Sector 2	Manufacturing, mining, and quarrying	45	44.55
Sector 3	Electricity, gas, and water	8	7.92
Sector 4	Construction	16	15.84
Sector 5	Wholesale and retail trade, transportation, and accommodation	14	13.86
Sector 6	Information and communication	6	5.94
Sector 7	Real estate activities	3	2.97
Sector 8	Professional, scientific, and support service activities	6	5.94
Sector 9	Other services	1	0.99
TOTAL		101	100

Given the usual requirements of dynamic panel data models, we construct a sample of firms that includes all non-financial companies listed in the Spanish stock exchange with at least six consecutive years of observations. The accounting information of the referred firms is obtained from the *Sistema de Análisis de Balances Ibéricos (SABI)*, a database managed by Bureau Van Dyck and Grupo Informa, S.A., while financial market information was provided by the quotation bulletins of the Spanish stock exchange.

Table 2
Descriptive Statistics

Variable	***Mean***	***Median***	***St. Dev.***	***Minimum***	***Maximum***
MDR	0.1068	0.0150	0.1717	0	0.9229
ROA	0.0524	0.0432	0.0599	-0.2058	0.4060
MTB	2.8547	1.1186	3.6164	-3.5923	10.2654
ETR	0.1848	0.1695	5.4862	-21.2503	187.5909
NDTS	0.0228	0.0163	0.0221	0	0.1814
SIZE	17.2132	17.7222	2.1779	11.3319	21.3704
TANG	0.5923	0.6204	0.2440	0.0507	0.9919
NTANG	0.0290	0.0063	0.0604	0	0.7235
IC	0.5622	0.1787	5.3246	-19.1171	151.2183
IDR	0.0435	0.0599	0.0864	0.0003	0.6120

MDR is the market debt ratio, *ROA* the return on assets, *MTB* the market-to-book ratio, *ETR* the effective tax rate, *NDTS* the non-debt tax shields, *SIZE* firm size, *TANG* tangibility, *NTANG* non-tangibility, *IC* interest expense coverage, and *IDR* the industry debt ratio.

Table 2 shows the main descriptive statistics of the dependent variable and the financial characteristics defining the target debt ratio. The financial characteristics are winsorized at the first and 99.th percentiles to avoid the influence of very extreme observations.

Table 3 reports the correlation matrix for our financial variables. According to most of the previous evidence, market debt ratios are negatively correlated with return on assets and the market-to-book ratio, and positively correlated with firm size. We also find a negative correlation between market-to-book ratios and non-debt tax shields, and between tangible assets and both return on assets and non-debt tax shields. Finally, the correlation between non-tangible assets and non-debt tax shields is positive. The only potentially problematic correlation for the empirical tests reported next is the large negative correlation coefficient between size and the market-to-book ratio.

TABLE 3
CORRELATION MATRIX

	MDR	*ROA*	*MTB*	*ETR*	*NDTS*	*SIZE*	*TANG*	*NTANG*	*IC*	*IDR*
MDR	1.000									
ROA	-0.284	1.000								
MTB	-0.530	0.122	1.000							
ETR	-0.020	-0.003	0.041	1.000						
NDTS	0.094	0.099	-0.214	-0.014	1.000					
SIZE	0.377	0.084	-0.758	-0.035	0.124	1.000				
TANG	-0.007	-0.119	0.154	0.006	-0.160	-0.079	1.000			
NTANG	-0.023	0.071	-0.046	0.007	0.274	0.056	-0.223	1.000		
IC	0.071	0.003	-0.082	0.029	0.043	0.021	-0.054	0.027	1.000	
IDR	0.372	-0.143	-0.329	-0.015	0.033	0.085	0.123	-0.031	0.004	1.000

MDR is the market debt ratio, *ROA* the return on assets, *MTB* the market-to-book ratio, *ETR* the effective tax rate, *NDTS* the non-debt tax shields, *SIZE* firm size, *TANG* tangibility, *NTANG* non-tangibility, *IC* interest expense coverage, and *IDR* the industry debt ratio.

5. EMPIRICAL RESULTS UNDER DYNAMIC PANEL DATA TECHNIQUE ESTIMATORS

5.1. ECONOMETRICS ISSUES

The empirical results about the speed of adjustment toward target leverage seem to be very sensitive to the econometric specifications employed. For example, Huang and Ritter (2009) show how the results depend on the econometric techniques employed in estimating the speed of adjustment. Under the new long difference estimator of Hahn, Hausman, and Kuersteiner (2007), an econometric technique especially appropriate for a dynamic panel when the dependent variable is highly persistent, Huang and Ritter (2009) estimate a relatively low speed of adjustment of 23.2 percent per year for market leverage. It is clear that the econometric unsettled issues associated with dynamic panel data makes it difficult to achieve consensus on the trade-off theory as tested by the speed of adjustment. It is well known that the simple OLS estimates of the lagged dependent variable's coefficient in these dynamic models are biased because the fixed effects are correlated with the lagged dependent variable. Additionally, the bias has a short-term component which seems to be especially severe under less than 30 years of data.

In response to these econometric difficulties, Flannery and Hankins (2011) are the first to compare the different methodologies in a capital structure context using Monte Carlo simulations to evaluate the accuracy of competing econometric methods. In this important paper, Flannery and Hankins (2011) use, among others, the Arellano and Bond (1991) GMM first-difference estimator designed to remove the time-invariant fixed effect, and the Blundell and Bond (1998) GMM system estimator with first-differenced instruments for the equation in levels and instruments in levels for the first-differenced equation. Given that the Blundell and Bond (1998) instruments seem to be invalidated by second-order autocorrelation of the errors, and their estimator can be biased and imprecise in panels with a small number of cross-sectional observations, Flannery and Hankins (2011) also employ the long difference estimation technique of Hahn, Hausman, and Kuersteiner (2007) who show that combining multi-period differencing with longer lagged instrument choices generate less biased estimates than the traditional GMM approaches within short balanced panel data samples (14). Finally, they also employ the bias-corrected least-squares dummy variable estimator (LSDVC henceforth) for unbalanced dynamic panels of Bruno (2005a) that calculates an explicit, data-dependent adjustment for the fixed effects bias in short dynamic panels. Their results show that, across a range of simulated parameters, the less biased estimators of both the lagged dependent and exogenous variables are Blundell and Bond (1998) system GMM and LSDVC. This latter estimator seems especially accurate with serial correlation in the regression residuals. Given this evidence, in this section we address the econometric problems using two alternative estimators: the Blundell and Bond (1998) system GMM, and the LSDVC of Bruno (2005a).

More specifically, consider a dynamic panel data of equation *(4)* where we explicitly recognize the unobserved fixed effects:

$$MDR_{jt} = (\lambda\beta)' X_{jt-1} + \rho MDR_{jt-1} + \mu_j + \varepsilon_{jt} \tag{6}$$

where $\rho = 1 - \lambda$ is one minus the speed of adjustment, and u_{jt} in *(4)* is composed of the unobserved time-invariant, firm-specific effect captured by μ_j (fixed effect) and the residual given by ε_{jt}. The simultaneous impact of fixed effects and a lagged highly persistent dependent variable severely biases the coefficient estimate of the speed of adjustment, particularly when the panel length is small (15).

In the first econometric procedure we employ in the present paper, we follow Blundell and Bond (1998) who propose a system GMM to correct for the weak instrument problem encountered by the Arellano and Bond (1991) estimator. They suggest building up a system of two equations, the level equation and the difference equation that instruments for the first difference of endogenous variables with lags of their own levels and differences. The practical problem is that the set of moment conditions for the system GMM estimator tends to explode as the time series increases, and the estimates can also be sensitive to the choice of instruments. Secondly, given the length of each panel in the data, we can calculate the resulting fixed effects bias and explicitly remove it from the estimated coefficients. This is the estimator proposed by Bruno (2005a) to extend the previous work by Kiviet (1995) to unbalanced panels. Bias approximations emerge with an increasing level of accuracy:

(14) Both, Huang and Ritter (2009) and Flannery and Hankins (2011) adapt the long difference estimator for unbalanced panels.
(15) This is known since the seminal paper by Nickell (1981), where it is shown that the least-squares dummy variable (LSDV) estimator is not consistent for finite length of the simple data in dynamic panel data models.

$$B_1 = c_1\left(\overline{T}^{-1}\right);\quad B_2 = B_1 + c_2\left(N^{-1}\overline{T}^{-1}\right),\quad B_3 = B_2 + c_3\left(N^{-1}\overline{T}^{-2}\right) \tag{7}$$

where B_i for $i = 1, 2$, and 3 are the bias corrections, N is the number of firms, T is the length of the sample period, $\overline{T} = n/N$ is the average group size, $n = \sum_{j=1}^{N} T_j$ and c_1, c_2, and c_3 depend on the unknown parameters ρ, which is one minus the speed of adjustment, and σ_ε^2 which is the variance of the residual in *(6)* [16]. The idea is to obtain the LSDVC estimator by subtracting any of the above terms from the LSDV biased estimator. Of course, we do not know the parameters ρ and σ_ε^2 needed to compute the bias corrections. Bruno (2005a) propose to employ either the Arellano and Bond (1991) or the Blundell and Bond (1998) to find consistent estimators for ρ and σ_ε^2, plugging them into the bias-correction formulas, and then subtracting the resulting bias approximation estimates, $\hat{B}_i$, from LSDV as follows [17]:

$$LS\hat{D}VC_i = LSDV - \hat{B}_i;\ i = 1,\ 2, \text{ and } 3 \tag{8}$$

5.2. Basic Dynamic Panel Data Empirical Results

Since we analyze Spanish public firms it is important to recall the previous findings about the speed of adjustment in Spain. The first empirical available evidence from Spanish public firms shows a relatively high speed of adjustment toward target debt ratios, at least with respect to the typical U.S. firm. De Miguel and Pindado (2001), using data from 1990 to 1997, report a surprisingly high speed of adjustment approximately equal to 0.79, which suggests that nearly 80 percent of the debt ratio is adjusted each year toward target leverage. González and González (2008), report that, between 1995 and 2004, the typical Spanish firm closes approximately 54 percent of the gap between its current and target debt ratios each year. However, more recently, Rubio and Sogorb (2011) provide new results under the long difference estimator of Hahn, Hausman, and Kuersteiner (2007) that seems to be much less biased than the traditional estimators employed in previous papers with Spanish data. Their results show that the typical Spanish firm moves much more slowly toward its target leverage than previously reported estimates. The speed of adjustment is found to be 17.5 percent, which indicates that approximately only one-fifth of the gap is closed each year. It must be pointed out that Rubio and Sogorb (2011) do not allow for asymmetric and costly capital structure adjustment [18].

Table 4 contains the results of estimating equation *(4)* for different categories of firms, and for the two econometric procedures. The first row includes over-levered firms while the second row contains under-levered firms. In the first two columns of Table 4, and for each row, we report the results for the high cash flow firms under System GMM and LSDVC respectively. Using the traditional System GMM procedure, and for the over-levered firms, we observe that companies with significantly high cash flows have an adjustment speed of 69.1 percent compared to 54.4 for those firms with medium level cash flows, and 47.4 for companies with particularly low levels of cash flows. The results

(16) The actual expressions of c_1, c_2, and c_3 can be found in Bruno (2005a).
(17) We implement these estimates using the user-written Stata procedure, «xtlsdvc» described by Bruno (2005b).
(18) They observe, however, a faster adjustment speed during economic states in which the distance between the current and target leverage is largest.

TABLE 4
ESTIMATION RESULTS OF THE PARTIAL ADJUSTMENT MODEL TOWARD TARGET LEVERAGE FOR OVER- AND UNDER-LEVERED FIRMS WITH ADJUSTMENT COSTS

	High CF		*Medium CF*		*Low CF*	
	System GMM	*LSDVC*	*System GMM*	*LSDVC*	*System GMM*	*LSDVC*
Over-levered (OL)	0.3089 (0.0228) $[\hat{\lambda} = 0.691]$	0.4838 (0.0172) $[\hat{\lambda} = 0.516]$	0.4559 (0.0144) $[\hat{\lambda} = 0.544]$	0.8080 (0.1437) $[\hat{\lambda} = 0.192]$	0.5258 (0.0222) $[\hat{\lambda} = 0.474]$	0.3217 (0.0161) $[\hat{\lambda} = 0.678]$
Under-levered (UL)	0.4262 (0.0119) $[\hat{\lambda} = 0.574]$	0.4686 (0.0629) $[\hat{\lambda} = 0.531]$	0.6403 (0.0511) $[\hat{\lambda} = 0.360]$	0.4939 (0.0894) $[\hat{\lambda} = 0.506]$	0.7226 (0.0256) $[\hat{\lambda} = 0.277]$	0.7219 (0.0877) $[\hat{\lambda} = 0.278]$
Number of obs.	154	154	204	204	154	154
Specification tests for the over-levered (OL) sub-sample						
AR(1) Test (OL)	–1.89 (0.00)	–2.39 (0.00)	–1.57 (0.00)	–2.21 (0.00)	–1.34 (0.00)	–0.45 (0.00)
AR (2) Test (OL)	–1.65 (0.29)	–0.46 (0.65)	–0.15 (0.88)	–0.12 (0.91)	–1.20 (0.23)	–0.79 (0.43)
Sargan Test (OL)	40.57 (0.32)	58.08 (0.40)	49.07 (0.28)	46.83 (0.36)	67.67 (0.26)	75.80 (0.37)
Specification tests for the under-levered (UL) sub-sample						
AR(1) Test (UL)	–1.26 (0.00)	–2.86 (0.00)	–1.16 (0.00)	–2.04 (0.00)	–1.37 (0.00)	–1.86 (0.00)
AR (2) (UL)	–1.28 (0.20)	–0.01 (0.99)	–0.97 (0.33)	0.28 (0.78)	–1.20 (0.23)	–1.40 (0.17)
Sargan Test (UL)	47.39 (0.38)	47.36 (0.33)	42.82 (0.22)	62.50 (0.20)	54.11 (0.21)	43.98 (0.37)

Panel regression coefficients estimated from equation *(4)* with standard errors in parentheses. For convenience, in brackets, we report the estimator of the speed of adjustment [one minus the coefficients estimated from equation *(4)*]. All the estimations include both time and sector dummies. The System GMM is the Blundell and Bond's (1998) estimation procedure. The second procedure corresponds to the bias-corrected least-squares dummy variable (LSDVC) estimator developed by Bruno (2005a). AR(1) and AR(2) Tests test the null hypothesis of no first- or second-order autocorrelation, respectively, in the residuals. The Sargan Test is a test of the over-identifying restrictions under the null hypothesis of instruments' validity.

for the under-levered firms show a similar decreasing (increasing) speed of adjustment relative to adjustment costs (cash flow realizations) with the important difference that over-levered firms show consistently, and independently of the level of the cash flow realization, a much faster speed of adjustment. For the under-levered companies, the estimates of the speeds of adjustment are 57.4, 36.0 and 27.7 percent for high, medium, and low cash flows, respectively. We may therefore conclude that the speed of adjustment seems to be an increasing (decreasing) function of cash flows realizations (adjustment costs). Firms with high cash flows, especially when they are over-levered, take the opportunity of having excess resources to move toward target leverage and, of course, in the case of over-levered firms, to reduce their degree of leverage. Although the pattern is the same for under-levered firms, it seems that these companies are less pressured to adjust their capital structure toward target market debt ratios. Spanish public firms respond to increased profitability, as measured by cash flow, by quickly moving toward their target leverage but are reluctant to adjust in response to intermediate or decreased profitability. This is clearly consistent with costly adjustment specification of the trade-off theory of capital structure.

The results using the LSDVC estimator, and the under-levered firms, are consistent with the previous findings. As before, the speed of adjustment is an increasing (decreasing) function of cash flows realizations (adjustment costs). High cash flow firms present a speed of adjustment equal to 53.1 percent, while the corresponding speeds for the medium and low cash flow firms are 50.6 and 27.8 percent, respectively. Surprisingly, the results are somehow different for the over-levered firms when we employ the LSDVC estimator. The speed of adjustments presents a u-shaped pattern relative to the cash flow realization. Over-levered firms, with high and low cash flow realizations have a much higher speed of adjustment than medium cash flow firms. This is consistent with the results reported for the U.S. companies by Faulkender, Flannery, Hankins, and Smith (2012) who argue that firms with high absolute cash flows are more likely to make leverage adjustments. Under this argument, the sign of the cash flow does not matter, just its absolute value is important. It should be noted that this argument is also perfectly consistent with the relevance of adjustment costs. In this sense, if a company has a low cash flow realization and needs to raise external funds (and has a leverage target), it can choose debt or equity depending on its over- or under-levered position.

Our evidence shows that the cross-sectional differences in the estimates of the speed of adjustment are substantial and demonstrate the relevance of recognizing the role of cash flows realizations when estimating the impact of adjustment costs in testing the trade-off theory of capital structure.

6. THE DUMMY VARIABLE APPROACH TO ESTIMATE THE SPEED OF ADJUSTMENT

It seems that, in the presence of costly adjustment, Spanish public firms take different adjustment speeds according to their financial position and cash flow level. Generally speaking, our previous results show that the speed of adjustment is a decreasing function of adjustment costs, and that over-levered companies have a higher speed of adjustment toward target than under-levered firms. However, for over-levered firms, when we estimate the partial adjustment model using LSDVC, we find that both high and low cash flow firms present a higher speed of adjustment.

An alternative estimation procedure to carry out a robustness check of our previous evidence is to employ the following dummy variable approach that allows the speed of adjustment to vary in three different states:

$$\Delta MDR_{jt} = \lambda_1\left(MDR^*_{jt} - MDR_{jt-1}\right)D_1 + \lambda_2\left(MDR^*_{jt} - MDR_{jt-1}\right)D_2 + \lambda_3\left(MDR^*_{jt} - MDR_{jt-1}\right)D_3 + u_{jt} \quad (9)$$

where D_1 is a dummy variable which is equal to one in the case that the cash flow of company *j* belongs to the high cash flow group and zero otherwise, D_2 is a dummy variable which is equal to one in the case that the cash flow of company j belongs to the medium cash flow category, and D_3 is a dummy variable which is equal to one in the case that the cash flow of company j belongs to the lowest cash flow group. We expect $\hat{\lambda}_1 > \hat{\lambda}_2 > \hat{\lambda}_3$.

It is important to note that the specification given by equation *(9)* is not a dynamic panel data model. The dependent variable does not appear in the right hand side with the usual one-period lag. The most problematic aspect of estimating regression *(9)* lies on an estimated target leverage, MDR^*_{jt}. Although the common approach is to estimate target leverage simultaneously with the speed of adjustment, as in the previous section of this paper, the estimation strategy now consists of estimating a target first and, in a second step, run a pooled OLS regression with bootstrapped standard errors to take into account the well known generated regressor problem of Pagan (1984).

We first estimate MDR^*_{jt} employing the dynamic panel data model given by *(4)* and using all companies in the data set for the full sample period. Since we are concerned with the robustness of our results when using System GMM and LSDVC, this first step on the estimation of expression *(9)* is based on the long difference estimator of Hahn, Hausman, and Kuersteiner (2007). In order to briefly describe this estimator, consider the dynamic panel data equation at the end of year t with fixed effects given by *(6)* (19):

$$MDR_{jt} = (\lambda\beta)' \; X_{jt-1} + \rho MDR_{jt-1} + (\mu_j + \varepsilon_{jt})$$

The dynamic equation at the end of year $t - k$ with fixed effects is given by:

$$MDR_{jt-k} = (\lambda\beta)' \; X_{jt-k-1} + \rho MDR_{jt-k-1} + (\mu_j + \varepsilon_{jt-k}) \tag{10}$$

Then, subtracting *(10)* from *(6)*, we get the equation to be estimated under the long difference estimator:

$$MDR_{jt} - MDR_{jt-k} = (\lambda\beta)' (X_{jt-1} - X_{jt-k-1}) + \rho(MDR_{jt-1} - MDR_{jt-k-1}) + (\varepsilon_{jt} - \varepsilon_{jt-k}) \tag{11}$$

In the long difference estimator, we begin estimating equation *(11)* by the system GMM to obtain the initial parameter estimators, using MDR_{jt-k-1} and X_{jt-k-1} as valid instruments. Then, we obtain the residuals of *(10)*:

$$\left(MDR_{jt-1} - \hat{\lambda}\hat{\beta}X_{jt-2} - \hat{\rho}MDR_{jt-2}\right),\ldots,\left(MDR_{jt-k} - \hat{\lambda}\hat{\beta}X_{jt-k-1} - \hat{\rho}MDR_{jt-k-1}\right)$$

and, finally, we employ MDR_{jt-k-1}, X_{jt-k-1}, and those residuals as new instruments. This is the first iteration. Our long difference estimator is obtained with two iterations and for $k = 3$. Under this procedure we again estimate the coefficients $\lambda\beta$ associated with the lagged determinants of capital structure. Given that we also have an *estimate of* $\rho \equiv 1 - \lambda$, we can extract the estimates of β. Then, for each company and each year in the sample period we calculate the target leverage as:

$$MDR^*_{jt} = \hat{\beta}' X_{jt-1} \tag{12}$$

Given the target leverages for each company and year, we can now run the pooled OLS regression with dummy variables and bootstrapped standard errors of equation *(9)*. Table 5 contains the results for the high, medium, and low categories where the group in which each firm is included in each year is determined by their cash flows being either in the 30 percent top or bottom of the cash flow distribution and the medium state is composed by the middle 40 percent of the distribution.

As before, the speeds of adjustments of over-levered firms are higher than those for under-levered firms. This is the case independently of the firm having either a high, medium or low cash flow realization. Moreover, the adjustment speed for over-levered firms is 41.7 percent for high cash flow companies, 36.0 percent for intermediate cash flow firms, and

(19) See Rubio and Sogorb (2011) for a more complete discussion of the econometric issues related to the long difference estimator when the dynamic panel data model is estimated with the same database as in this paper.

only 18.0 percent for low cash flow companies. Similarly, the adjustment speed for under-levered firms is 36.0 percent for high cash flow companies, but again only 19.0 and 16.7 percent for medium and low cash flow firms respectively. Clearly, there is strong evidence that both the level of leverage relative to the industry median and the adjustment costs, approximated by cash flow realizations, are very important determinants of the speed of adjustment toward target leverage.

TABLE 5

DUMMY VARIABLE ESTIMATION RESULTS OF THE PARTIAL ADJUSTMENT MODEL TOWARD TARGET LEVERAGE FOR OVER- AND UNDER-LEVERED FIRMS WITH ADJUSTMENT COSTS

	Over-levered	*Under-levered*
	OLS with bootstrapped se	***OLS with bootstrapped se***
$\hat{\lambda}_1$	0.4172 (0.0503)	0.3597 (0.0767)
$\hat{\lambda}_2$	0.3599 (0.0632)	0.1901 (0.0592)
λ_3	0.1800 (0.0589)	0.1669 (0.0427)
Number of obs.	434	425
Adjusted R-Squared	0.208	0.276

OLS pooled regression coefficients estimated from equation (9) with bootstrapped standard errors in parentheses. The target market debt ratio is previously estimated using a dynamic panel data model and the long difference estimator of Hahn, Hausman, and Kuersteiner (2007). $\hat{\lambda}_1$, $\hat{\lambda}_2$ and $\hat{\lambda}_3$ are the estimated speed of adjustment for high cash flow, medium cash flow and low cash flow companies, respectively.

7. ACTIVE VS. PASSIVE DEBT MARKET RATIOS

Faulkender, Flannery, Hankins, and Smith (2012) estimate a model that controls for each firm's endogenous choice to access external capital markets. The appropriate empirical specification should distinguish between active leverage adjustments and passive or random adjustments that take place without accessing external markets. They argue that in the presence of transaction costs, tests of target adjustment models should focus only on active adjustment. Specifically, leverage is likely to change from the previous market debt ratio passively, when the firm includes annual net income to its equity book account. Then, they measure the deviations from both actual and target leverage at time t to a measure of the past debt ratio that includes in the denominator outstanding book assets at time $t-1$ plus net income during the year ending at time t.

We therefore modify expression *(1)* to separate a firm's leverage change into a passive and an active adjustment. Only active adjustment generates transaction costs which imply that tests of target adjustment modes should focus on active adjustment. We now estimate the following dynamic model to separate any leverage change into a passive or mechanical components and active adjustment:

$$MDR_{jt} - MDR_{jt-1}^{P} = \lambda\left(M\hat{DR}_{jt}^{*} - MDR_{jt-1}^{P}\right) + u_{jt} \tag{13}$$

where, as before $M\hat{DR}^{*}_{jt} = \hat{\beta}'X_{jt-1}$, and the new market-debt ratio is given by:

$$MDR^{P}_{jt-1} = \frac{D_{jt-1}}{D_{jt-1} + n_{jt-1} P_{jt-1} + NI_{jt}} \quad (14)$$

and NI_{jt} is the net income during the year ending at time t. It should be noted that the market debt ratio at year t would be MDR^{P}_{jt-1} if the firm does not access to either external capital or to bank borrowing activities. This implies that the left hand side of *(13)* represents the firm's active capital structure changes. This estimation strategy allows for an unambiguous interpretation of the λ coefficient as the true speed of adjustment toward target leverage.

Once again, given that expression *(13)* is not a truly dynamic panel model, we employ two-step estimation, where in the second step we run an OLS regression with bootstrapped standard errors. The results are reported in Table 6. As before, over-levered firms have higher speeds of adjustments relative to under-levered firms. Although the differences are not so large as before, this is the case for all levels of cash flow realizations. It is also interesting to note that, as expected, the speed of adjustment is now much lower than in Table 4. These are just active changes in leverage ratios toward target. Finally, it is now clear that, independently of the amount of leverage, the higher speed of adjustment is always found for firms with especially high cash flows realizations. High cash flow firms present a speed of adjustment equal to 34.2 and 31.7 percent for over- and under-levered companies respectively. Given that we now separate active versus passive changes toward target, we are able to conclude unambiguously that excess resources are the single most important determinant of the speed of adjustment toward target leverage when costly transactions are in place. Firms seem to employ actively their extra resources to change optimally their capital structure which is consistent with the trade-off theory of capital structure with adjustment costs.

Table 6

Estimation results of the partial adjustment model toward target leverage for over- and under-levered firms with adjustment costs and active leverage policy

	High CF	*Medium CF*	*Low CF*
Over Levered (OL)	0.3418 (0.0527)	0.2334 (0.0896)	0.2366 (0.0765)
Under Levered (UL)	0.3171 (0.0943)	0.2138 (0.0551)	0.2170 (0.0441)
Number of obs.	154	204	154
Adjusted R-squared for the over-levered (OL) sub-sample			
Adjusted R-Squared	0.151	0.132	0.117
Adjusted R-squared for the under-levered (UL) sub-sample			
Adjusted R-Squared	0.144	0.126	0.135

OLS pooled regression coefficients estimated from equation *(13)* with bootstrapped standard errors in parentheses. The target market debt ratio is previously estimated using a dynamic panel data model and the long difference estimator of Hahn, Hausman, and Kuersteiner (2007).

8. CONCLUSIONS

The inconclusive evidence regarding the validity of the speed of adjustment as an appropriate empirical instrument to test the trade-off theory of capital structure has led researchers to pay attention to asymmetric responses of firms to move toward target leverage. A key aspect of this research deals with the importance of the asymmetric impact on the speed of adjustment of costly adjustments depending upon firms' characteristics. This paper investigates these issues for a representative sample of Spanish public firms which can be understood as an important example of a civil law originated country.

We find that cross-sectional variation in cash flow that proxies for adjustment costs is associated with differences in adjustment speeds toward a target capital structure. We report that during years in which Spanish public firms make changes in their financing decisions, as a result of their high cash flow realizations, they close significantly more of the gap between current and target capital structure than those firms with intermediate and low cash flows realizations. As in the U.S. market, adjustment costs seem to be a key factor to explain the trade-off theory of capital structure. Moreover, given transaction costs, the benefits of eliminating excess leverage seem to exceed the benefits of moving toward target leverage from below. In particular, over-levered Spanish public firms with high cash flow realizations close significantly more of the gap between current and target capital structure than those over-levered firms with medium and low cash flows observations, and also more than those under-levered firms with intermediate and low cash flows realizations.

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