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Do Portuguese private firms follow pecking order financing?

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This paper tests for pecking order behavior in medium-sized private Portuguese firms. In contrast to the usual split between internal funds, debt, and external equity, we separate debt into four components – cheap trade credits (CTC), bank loans (BL), other loans, and expensive credits (EC). We use breakpoint tests to identify when firms switch between funding sources by examining the change in each funding source based on the financing deficit remaining after the previous pecking order funding source has been used. Our tests indicate that Portuguese companies generally move from lower cost to higher cost financing sources, but they do not exhaust each type of debt before moving on to the next funding source in the pecking order. Such behavior is consistent with a loose interpretation of pecking order financing, but not a strict interpretation of the theory. Instead, Portuguese firms may be balancing pecking order financing with a need to maintain some degree of financing flexibility.

Keywords: capital structure; pecking order theory

JEL Classification: G3; G32

1. Introduction

The pecking order theory of capital sturcture has been extensively tested in the finance literature since it was first proposed by Myers and Majluf (1984). The theory asserts that firms prefer to use internally generated funds, then debt, and finally external equity in financing their operations. According to Myers and Majluf (1984), the rationale for the pecking order is asymmetric information. Managers have access to information that others do not, and bankers in turn, have more information about a firm's prospects than outsiders providing external equity. Although the theory behind the pecking order seems logical, empirical tests of the hypothesis have produced contradictory results. Numerous papers support either the original pecking order theory or a less restrictive version of the hypothesis (Shyam-Sunder and Myers 1999; Fama and French 2002; Lemmon and Zender 2004), while other studies find little evidence of a pecking order in firm financing (Frank and Goyal 2003; Fama and French 2005).

Many studies have tested the pecking order hypothesis by observing whether firm-specific variables respond in the expected direction to changes in debt. For example, leverage should be negatively related to profitability and positively related to past dividends paid. However, it is

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possible to directly test the two key predictions of the pecking order theory. The first prediction is that the first external funding source (debt) is used to cover the funding deficit until this source is exhausted. Additional funding deficits are funded by the next cheapest source, etc. A simple test of this prediction is a linear regression of the change in debt on the funding deficit. The regression function should show a kink at the point of exhaustion of each debt source. The second prediction is that the regression slope coefficient before the kink is one – reflecting that each debt source, in order, covers the funding deficit if the amount of debt is below the kink. After the kink, where a debt source is exhausted, the next cheapest source is used and the slope coefficient is zero after the kink. Shyam-Sunder and Myers (1999) were the first to utilize this framework, although they assumed that the firm would not use external equity and that debt would cover the entire funding deficit. Their function therefore shows no kink and they only had to test for one slope coefficient for their one source of homogenous debt. Chirinko and Singha (2000) have shown that the test by Shyam-Sunder and Myers (1999) has little power to distinguish between the competing theories of capital structure. The problem may be that the Shyam-Sunder and Myers test uses linear regression to estimate a relationship that is better described by a kinked model. Also, firms may utilize more than one kind of debt and/or use external equity. A more complete representation of pecking order financing implies that there are distinct breaks between financing choices.

The purpose of this paper is twofold. First, we adapt the Shyam-Sunder and Myers (1999) test for the pecking order taking into account of the indeterminacy identified by Chirinko and Singha (2000). We apply Andrews (1993) and Andrews and Ploberger (1994) tests to determine, as predicted by the theory, whether there are specific breakpoints between funding sources as a firm's financing deficit changes. Once breakpoints are established, dummy variables are used to estimate two separate relationships between the financing deficit and choice of funding. That is, we estimate the kink in the Shyam-Sunder and Myers (1999) regression equation for the change between each funding source. Second, to make pecking order financing decisions more relevant for smaller firms, we examine financing decisions between internal equity financing and four categories of debt: CTC, short-term and long-term BL, loans from other financial institutions, and expensive trade credits (ETC) and other expensive debt. Our approach contrasts with traditional pecking order theory where the choice of funding sources is between internal funds, debt as a broad category, and external equity.

Pecking order financing is tested using a proprietary data set consisting of the annual financial statements of about 700–800 unlisted medium-sized firms in Portugal over the period 1990–2000.[1] These data are specifically chosen because of the detail it provides in the area of debt financing. *A priori*, our Portuguese data set contains firms that the finance literature would identify as likely to display pecking order theory and our test procedures do loosely support the notion of pecking order financing.[2] However, our results are not consistent with a strict interpretation of pecking order theory. Although we find that Portuguese firms generally move from lower cost to higher cost financing sources, they do not exhaust each type of debt before moving on to the next funding source in the pecking order. Such behavior may be consistent with pecking order theory balanced with the need to maintain some degree of financing flexibility.

The remainder of the paper is organized as follows. Section 2 provides a brief literature review of the pecking order and other models of capital structure, Section 3 discusses the data, Section 4 lists the proposed pecking order of financing for Portuguese private firms, Section 5 develops the theoretical model for testing pecking order theory, Section 6 presents the results of the tests, and Section 7 provides some concluding remarks.

2. Literature review

2.1 *Theories of capital structure*

The two primary theories explaining the firm's capital structure are the static trade-off model derived from the work of Kraus and Litzenberger (1973), Miller (1977), Scott (1977), and Kim (1978) and the pecking order theory proposed by Myers and Majluf (1984). Trade-off theory is based on the notion that firms balance the marginal benefits from using lower cost debt instead of equity against the marginal costs of greater debt – which involve bankruptcy costs and possible agency costs. Trade-off theory suggests there is either an optimal debt–equity ratio or a range for this ratio that minimizes a firm's average cost of capital.

Pecking order theory is driven by the costs of asymmetric information and the desire to reduce the transaction costs of financing. Firms will first use internal funds to finance projects because they are the lowest cost funding source. They will then move to external debt financing rather than external equity. Due to the problem of asymmetric information, investors will be suspicious of providing external equity – primarily because firms are more likely to issue new equity when they believe their shares are over-valued.

As surveyed in Rajan and Zingales (1995), a vast literature has developed that tests these two popular theories, as well as other explanations (e.g. signaling or agency problems) for corporate capital structure. Although neither the trade-off nor the pecking order theory has been convincingly proven, neither has been decisively rejected. Yu and Aquino (2009) suggest that the empirical evidence favors the pecking order theory over the static trade-off theory, while Fama and French (2002) suggest treating the two theories as if they were in a 'horse race' to explain capital structure. Instead of being contradictory, the two theories could be considered 'stable-mates' where each explains some aspects of the capital structure. Also, while some capital decisions may be compatible with both theories, still other aspects of the capital structure cannot be explained by either of the theory.

2.2 *Tests of capital structure theories*

Qureshi (2009) has divided the tests for capital structure into three main categories: (1) surveys and interviews, where corporate insiders are simply asked about the determinants of capital decisions, (2) examining the sign of leverage on firm-specific variables, which can be used to test for either trade-off theory or pecking order theory, and (3) the test of pecking order theory in isolation, which is characterized by the Shyam-Sunder and Myers (1999) test of the impact of the financing deficit on changes in funding sources.

As an example of the survey method, Graham and Harvey (2001) asked 392 US chief financial officers (CFOs) about capital structure decisions within their firms. Their survey evidence supported trade-off theory and the pecking order, as well as providing evidence that signaling and agency costs drive some capital structure decisions. Bancel and Mittoo (2004) and Brounen, de Jong, and Koedilk (2006) have conducted similar surveys of capital structure decisions with European CFOs. Although Bancel and Mittoo (2004) found that 75% of surveyed firms across 16 European countries had a target debt–equity ratio, they also reported modest evidence for a pecking order and for capital structures influenced by signaling and agency problems. Similarly, Brounen, de Jong, and Koedilk (2006) indicated that most large firms in Netherlands, UK, Germany, and France maintain a target debt ratio. Firms move from lower to higher cost funding sources as their financing needs increase, but their survey evidence only supports a loose version of the pecking order, rather than the literal interpretation of the theory. Furthermore, financial

flexibility was deemed important for reasons other than the pecking order, and asymmetrical information was not primarily responsible for the choice of financing sources.

The most popular technique for testing competing models of capital structure is to use linear regression to determine the relationship between various measures of leverage- and firm-specific variables, such as profitability, size, growth, and dividend payments. Trade-off theory predicts that more profitable firms will take on more debt, that the debt–equity ratio increases with firm size up to the optimal ratio, and that various debt–equity ratios fluctuate over time around the optimum or target leverage ratio. Pecking order theory suggests a negative relationship between leverage and variables such as growth and profitability, and a positive relationship between past dividends and current leverage.

These rather indirect tests of capital structure theories permit a comparison between trade-off and pecking order theory, but they sometimes fail to adequately distinguish between the two models. Booth et al. (2001) has argued that comparisons between models (such as in those Fama and French (2002), who find a negative relationship between leverage and both profitability and growth opportunities in support of pecking order theory) may be contaminated by spurious relationships because of the market value of equity entering variables on both the left and right-hand sides of regression equations. Furthermore, Strebulaev (2007) notes that the debt-profitability relationship may not always distinguish between various capital structure theories. As an example, if a firm has temporarily exceeded its target debt–equity ratio, an increase in future profitability from reducing debt would be consistent with both the trade-off and pecking order theories.

Regardless of the power of these tests, a sizeable literature has examined the relationship between debt and variables such as firm size, profitability, and dividends in various countries. For example, Allen (1993) found evidence of pecking order behavior for 89 large listed Australian firms over the period 1954–1982. Tong and Green (2005) built upon the Allen (1993) framework to test capital structure theories for 50 large Chinese companies over the years 2001–2003. Their evidence favored the pecking order, but they could not reject trade-off theory. Similarly, Qureshi (2009) adapted the Allen (1993) and Tong and Green (2005) models to Pakistani data for the period 1972–1994 and found that the pecking order hypothesis was preferred to trade-off theory.

Hol and Van der Wijst (2008, 559) examined the financial structure of over 100,000 unlisted firms in Norway over the period 1995–2000 and noted that '(T)he scarcity of empirical evidence for non-listed firms is the motivation' for their article. They rejected pecking order theory and hypothesized that the relationship between debt and profitability is more complex than described in standard theories. That is, profitability may be positively related to short-term debt and negatively correlated with long-term debt. Using about 400 firm years (41 firms) of listed Portuguese companies over the period 1991–2004 (similar time period to our sample), Serrasqueiro and Rogão (2009) provided mixed support in favor of both trade-off and pecking order theory. Although debt converged towards a target debt ratio, debt and profitability were negatively related as predicted by pecking order theory. Finally, Yu and Aquino (2009) examined 1318 firm-years of data for large listed Philippine firms over the period 1990–2001 and noted that pecking order theory better explained capital structure in the Philippines than trade-off theory.

A more direct test for pecking order behavior proposed by Shyam-Sunder and Myers (1999) is a linear regression of each firm's financing deficit on its change in debt level. A strict interpretation of pecking order theory requires a one-to-one relationship between the two variables, but Shyam-Sunder and Myers (1999) found a coefficient on the financing deficit of about 0.75. They argued that since the coefficient was significantly different from zero and reasonably close to one, their results were consistent with the predictions of pecking order theory. We adopt a modified version

of this test in Section 5 to examine the impact of the residual financing deficit on changes in the levels of various types of debt financing.

Direct tests of the pecking order hypothesis have been less prevalent in the literature than the indirect tests discussed above. Nevertheless, Fama and French (2000) provided evidence in favor of pecking order finance for US firms and Yu and Aquino (2009) supported pecking order theory using data on Philippine firms. Serrasqueiro and Nunes (2010) suggest that pecking order and trade-off theory are not mutually exclusive based on evidence from large Portuguese companies over the period 1998–2006, while Frank and Goyal (2003) found little evidence for the pecking order among US firms. Leary and Roberts (2010) have simulated the accuracy of this test on a sample of over 34,000 US firms during the period 1989–2005. They presented seven models ranging from the strictest interpretation of pecking order theory to the loosest possible interpretation. Under the strictest interpretation of the theory, less than 20% of firms follow a pecking order model, while under the loosest possible interpretation, which allows debt capacity to vary with variables such as firm size (as suggested by trade-off theory), about 80% of firms follow some sort of pecking order. Somewhat surprisingly, Leary and Roberts (2010) confirm the Frank and Goyal (2003) finding that large firms, and not small firms, are more likely to follow pecking order financing. In contrast, Bharath, Pasquariello, and Wu (2009) have recently confirmed the more common expectation that asymmetric information drives pecking order behavior and that small firms are more likely to follow a pecking order than large firms.

Following Zingales' (2000) comment that analysis of the capital structure of small-to-medium size enterprises (SMEs) had been a neglected area of research, several studies have addressed the financing decisions of SMEs and some work has extended this analysis to non-listed firms. For example, Bhaird and Lucey (2010) found that Irish SMEs behaved in a manner roughly consistent with pecking order theory and that there were no major differences between the capital structure of service and manufacturing SMEs. Lopez-Gracia and Sogorb-Mira (2008) tested the Shyam-Sunder and Myers (1999) model and showed that the financing deficit was positively related to variations in the debt level, thereby confirming pecking order behavior for non-listed Spanish SMEs. In studies of the Portuguese service industry, Nunes and Serrasqueiro (2007) supported both pecking order and trade-off theory for large firms, while Serrasqueiro (2011) found greater informational asymmetry for non-listed service SMEs relative to unlisted manufacturing SMEs. Her results suggest a greater likelihood of observing pecking order behavior in the service sector relative to manufacturing.

3. Data

The primary data source for this study is the Bank of Portugal Statistical Department database. It contains balance sheet and income statement data on 1811 unlisted firms with 11,359 non-continuous firm year observations over the period 1990–2000. Several selection criteria were imposed upon the database to reach the final sample for use in this paper. Only manufacturing firms with more than 100 employees for at least 1 year were included.[3] This restriction minimizes the number of cases where the personal wealth of the owner or the owner's family is used to guarantee loans of the firm.[4] Also, firms with negative net worth and those firms with less than 3 continuous years of data were not included in the sample. The final sample consists of 1416 medium-sized private firms and 7546 firm year observations. Table 1 provides the industrial composition and sample size of our data set of Portuguese firms. It is an unbalanced panel because only 271 of 1416 firms have data for the full 10-year sample period.[5] Nevertheless, the number of observations is rather evenly distributed among years with between 700 and 800 observations per year, and

Table 1. Number of firm year observations across years and industries.

	Industry						
Year	Food and drinks	Textiles and clothes	Wood and paper paste	Chemical products	Heavy industry	Machinery and equipment	Total
1991	102	236	56	125	53	127	699
1992	114	278	61	119	49	139	760
1993	107	272	63	121	48	128	739
1994	105	274	59	120	50	133	741
1995	109	274	67	130	51	137	768
1996	108	270	71	130	51	134	764
1997	106	272	70	132	56	128	764
1998	113	282	67	133	63	140	798
1999	111	277	70	133	61	138	790
2000	97	232	59	133	65	137	723
Total	1072	2667	643	1276	547	1341	7546

Table 2. Sources of funds for Portuguese manufacturing firms.

	1990	1994	1998	2000
	% of total funds provided by			
Equity	49	46	49	46
Creditors (trade credit)	10	12	12	14
Banks[a]	20	19	16	18
OI and miscellaneous providers of credit[b]	15	16	15	14
Provisions and accrued expenses	6	7	8	8

[a]Long-term BL and short-term BL.
[b]The sum of other long-term debts, other non-current liabilities, and other current liabilities.

across the six industry groups – food and drinks, textiles and clothes, wood and paper paste, chemical products, heavy industry, and machinery and equipment. Regarding the distribution of observations across industries, textiles and clothes includes about a third of the total observations, and heavy industry and wood and paper paste each contain about 15% of total observations. These sample percentages are fairly representative of the industrial sector nation-wide based on data for all sized firms as presented in the Bank of Portugal Statistical Department database.

Table 2 presents summary information for each general funding source as a percentage of all funds raised by a typical firm. Portuguese firms meet their financing needs with nearly 50% equity, which is similar to levels reported by Berger and Udell (1998) for SMEs in the USA. In contrast, Rajan and Zingales (1995) report that large listed firms in the G7 countries have equity percentages ranging from 28% in Germany to 42% in the UK. Banks provide 16–20% of the financing for Portuguese medium-sized firms, trade credits from suppliers constitute about 12%, while other institutions (OI) and miscellaneous providers of credit (including leasing and factoring) account for around 15% of total financing. The remaining 6–8% of funds come from provisions and accrued expenses. Provisions probably represent internal equity, while accrued expenses are short-term liabilities recognized this year for expenses that will occur next year (e.g. vacation subsidies, social expenses, and rent) and can be funded using any source.

Table 3. Average liabilities and equity of Portuguese manufacturing firms.

	1990	1992	1994	1996	1998	2000
Shareholder's funds	**0.49**	**0.47**	**0.46**	**0.48**	**0.49**	**0.46**
Capital	0.22	0.21	0.25	0.25	0.24	0.20
Reserves	0.23	0.25	0.19	0.21	0.22	0.21
Net income of the year	0.04	0.01	0.02	0.02	0.03	0.05
Provisions	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
Liabilities	**0.49**	**0.52**	**0.53**	**0.51**	**0.50**	**0.53**
Non-current liabilities	0.16	0.15	0.14	0.15	0.13	0.13
Long-term debt	0.13	0.12	0.09	0.11	0.09	0.10
BL	0.10	0.10	0.07	0.09	0.08	0.09
Other	0.03	0.02	0.02	0.02	0.01	0.01
Other non-current liabilities	0.03	0.03	0.05	0.04	0.04	0.03
Current liabilities	0.33	0.37	0.39	0.36	0.37	0.40
Loans	0.10	0.13	0.12	0.08	0.08	0.09
BL	0.10	0.13	0.10	0.08	0.08	0.09
Others	<0.01	<0.01	<0.01	<0.01	<0.01	<0.00
Creditors	0.10	0.10	0.12	0.12	0.12	0.14
Other current liabilities[a]	0.09	0.09	0.09	0.09	0.10	0.10
Accrued expenses	0.04	0.05	0.06	0.07	0.07	0.07

Notes: The reported values are the fraction of shareholder funds and liabilities as a portion of total assets. They represent the right-hand side of an average common-size balance sheet for the 1416 Portuguese private medium-sized firms.
[a]Loans from shareholders.

While the existing literature on capital structure has focused on the generic debt-equity trade-off, our sample of Portuguese companies permits a more detailed analysis of firm choices between equity and various higher and lower cost sources of debt.

Although all balance sheet information is available for our data sample, the information most crucial to test pecking order financing is the right-hand side of the balance sheet or the information on liabilities and owner's equity as a source of funds. Such information for Portuguese firms for selected years is presented in the form of a common-sized balance sheet in Table 3. The amount of current liabilities for Portuguese firms ranges from 33% to 40% of assets. For SMEs in G7 countries, it ranges from 23% for Canada to 43% for France. The composition of current liabilities is dominated by BL (between 8% and 13%) and trade credits (between 8% and 14%), while other liabilities represent about 10% of total assets. Banks provide 9% to 13% of common-size long-term debt and if added to loans from other financial institutions, total loans account for 20% to 25% of financing for Portuguese companies. This is nearly identical to Berger and Udell (1998), who found that banks account for 25% of US small business financing. Trade credits of 10% to 14% of funding are only slightly smaller than the 15% number reported by Berger and Udell (1998) for the US. Thus, medium-sized firms in Portugal are financed much like SMEs in the US, but somewhat different than large listed firms in the G7.

4. Expected pecking order of financing for Portuguese firms

The pecking order of financing sources for Portuguese private firms is driven by the degree of asymmetric information and the estimated cost is of each source. Our predicted pecking order is internal equity, CTC, BL, credit from other financial institutions, overdrawn or ETC, and finally miscellaneous other debt (OD). Since our sample contains only unlisted companies, external equity is not a source of funding.

Under pecking order financing, internal equity should be the preferred source of funds and Table 2 indicates that it provides about half of the funding for Portuguese firms. Clearly, owners have the most information about the firm, and the use of internal equity sends a strong signal that the owners believe in the firm's future prospects.

The second source in the pecking order should be trade credits.[6] They allow the buyer to verify the quantity and quality of a firm's products before submitting payments and they help to establish long-term relationships between suppliers and buyers. By issuing trade credits, large firms with direct access to financial markets essentially compete with financial institutions in extending credit to smaller firms. According to Petersen and Rajan (1997), suppliers may have advantages over financial institutions in collecting payments and with their general knowledge of the firm and the industry, the level of asymmetric information is lower than for other sources of debt finance.

In a trade credit contract, the firm gets a discount if it pays within a certain time period (e.g. 30 days) and it pays a penalty for late payments. Thus, the firm has the option of cheap financing if it pays on time and expensive financing if it delays payment.

The trade credit contract in Portugal is simpler than the standard trade credit contract. For example, a standard contract could be quoted as 2–10 net 30 – meaning that the contract has a discount rate of 2% if the customer pays the bill within 10 days. Otherwise, the full amount is due in 30 days. In Portugal, a quote of 2 net 30 means that the customer receives the full 2% discount if the bill is paid within 30 days.[7] However, the customer forgoes the discount and may pay an additional penalty if payments are not made by the due date.[8] According to Eurofactor (2006), the average payment period for Portugal was 53 days in 2003 – meaning that many firms pay the penalty and use ETC.[9]

In theory, the distinction between CTC and ETC should be straight forward. If the number of credit days is greater than the number of days specified in the contract, then trade credits are expensive. If payments are made on time, they are classified as CTC, otherwise they are expensive. However, Portuguese balance sheets do not provide details about trade credits, so we had to estimate the number of days, terms, and standard deviation of credit days for firms to obtain a cut-off point between CTC and ETC for each of the six industrial sectors.[10] Table 4 provides the estimated number of firms in each industrial sector utilizing cheap versus ETC. Note that the machinery production and equipment industry primarily avoids ETC, while nearly half of the companies in the food and drinks sector rely upon this expensive source of financing.

Following CTC, BL should represent the third source in the financial pecking order. Banks have some clear advantages over other financial institutions in solving the asymmetric information problem for small firms since banks are also involved in the firm's payment function. Banks collect information through due diligence and by monitoring the transaction accounts of firms.

Table 4. Estimated distribution of ETC.

Industry	Number of firms	Percentage of firms with EC	EC as percentage of total credits
Food and drinks	818	47.066	63.576
Textiles and clothes	1913	27.757	38.889
Wood and paper paste	481	16.008	19.143
Chemical products	956	33.682	32.869
Heavy industry	383	47.258	41.446
Machinery production and equipment	954	8.071	5.965

By offering both short- and long-term loans, banks can withdraw funds and/or renegotiate the conditions of a loan and interest rates if a firm engages in moral hazard activities, such as risk shifting or taking on too much risk.

Other financial institutions in Portugal extend specific loans, such as equipment loans or car loans, and some of these institutions are involved in equipment and vehicle leasing. Leasing is an efficient way of resolving the costs of financial distress because the lessor can simply retrieve the asset if payments are missed, but this fourth source of funds is subject to more asymmetrical information than bank financing. While banks are involved in the firm's payment functions and a given bank may have multiple financial relationships with firms, OI have fewer and often only one financial arrangement with a given firm. As a result, financing from OI should be more expensive than BL.

ETC and OD represent the most expensive sources of debt financing. We hypothesize that ETC would be the next financing source, not because it is necessarily much cheaper than OD, but simply because it is easier to obtain. No special arrangements are needed and a firm uses ETC simply by not paying its suppliers on time. Such financing should be a source of last resort because its financial cost as well as the possible damage it does to firm reputation. Nevertheless, as given in Table 4, ETC are more prevalent than might be expected. They range from about 6% to 64% as a percentage of total trade credits extended, depending upon the sector considered.

Finally, OD represents miscellaneous (usually short-term) financing arrangements that often constitute emergency financing. Included in this category are credit card debt and arrangements involving factoring, whereby a firm obtains immediate access to money from accounts receivables to meet short-term obligations. In Table 3, these debt sources were represented by other current and other non-current liabilities.

5. Tests of pecking order financing

Shyam-Sunder and Myers (1999) test pecking order theory using the following regression equation that estimates the change in debt for firm i in period t (ΔDebt_{it}) as follows:

$$\Delta\text{Debt}_{it} = \alpha + \beta_{\text{PO}}\,\text{DEF}_{it} + e_{it}, \tag{1}$$

where e_{it} is an error term, α is the intercept, and DEF_{it} is the financing deficit for any firm in period t. Following Shyam-Sunder and Myers (1999), in order to make meaningful comparisons across firms of various sizes and to reduce problems with heteroskedasticity, changes in debt and the various components of the financing deficit are divided (or scaled) by the book value of assets.[11] Ignoring the firm-specific subscript (i), the financing deficit at each point in time is defined as:

$$\text{DEF}_t = \text{DIV}_t + X_t + \Delta W_t + R_t - C_t, \tag{2}$$

where DIV_t is dividend payments, X_t is capital expenditures, ΔW_t is the net increase in working capital, R_t is the current portion of long-term debt at start of period, and C_t is operating cash flows after interest and taxes. The pecking order hypothesis predicts that $\beta_{\text{PO}} = 1$ and that $\alpha = 0$, meaning that internal funds are used first and any additional financing is obtained using debt.

Shyam-Sunder and Myers (1999) found that the coefficient on the deficit (β_{PO}) was statistically close to one – thereby supporting the pecking order theory. Equity is not included in Equation (2) because Shyam-Sunder and Myers (1999) believed that a firm will issue or retire equity only as a last resort. This is assumed to be a rare occurrence – a claim that is disputed by Frank and Goyal (2003).

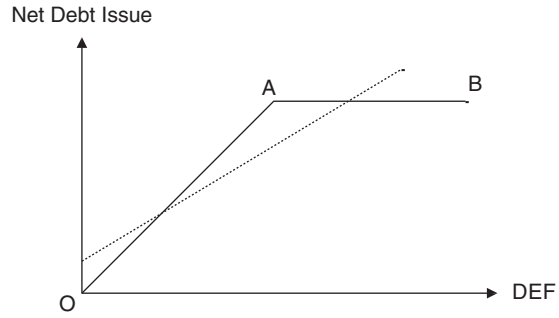

Figure 1. Potential bias in traditional empirical tests of pecking order finance.

A more devastating critique of the Shyam-Sunder and Myers (1999) test has been levied by Chirinko and Singha (2000). They show that the tests performed by both Shyam-Sunder and Myers (1999) and Frank and Goyal (2003), as in Equation (1), are only correctly specified if firms do not issue external equity. The issuance of external equity biases both the slope coefficient and the intercept as can be seen in Figure 1. For example, assume that the first 80% of all firms issue one dollar of debt for each dollar of deficit financing represented by the 45° line from O to A. Then, further assume that the last 20% of all firms, having exhausted their ability to raise more debt, issue external equity as represented by A to B on the horizontal line. Estimating Equation (2) on a data set where 20% of all firms issue external equity and without accounting for the kink, the slope of the estimated line becomes 'an average' of a line with a slope of one and a line with a slope of zero, as represented by the dotted line. The estimated slope coefficient is less than one for this type of data.

From an econometric point of view, there are two problems in estimating Equation (2) with a kink or breakpoint. The location of the kink is unknown and it is not clear that all firms face the same 'kink', i.e. firms have different debt capacities. For the Portuguese sample, it is not possible to jointly test for debt capacity and for a breakpoint. Thus, it is assumed that all firms in the same industry have the breakpoint or debt capacity for each type of debt.[12] To mitigate the impact of this assumption, we divide the changes in each source of debt and the components of the financing deficit by total assets. This makes comparisons across various sizes of firms possible on a percentage basis.

The testing procedure utilized below makes use of the idea of the kink as shown in Figure 1. Assuming a Portuguese firm has five possible external sources of debt finance; the sources are denoted in preference order as CTC, BL, OI, ETC, and OD. For each of the funding sources, there is a dollar for dollar relationship between the funding deficit and the change in funding source – provided that the funds obtained from this source are below the capacity for this type of funding.[13] As in Figure 1, a kink is assumed to exist for each funding source. The slope coefficient will be equal to one up to the breakpoint and zero thereafter. After the breakpoint, the firm would move on to the next most preferred source of funding.

The data are sorted by the funding deficit and the following regression is estimated for the first source of debt funding, which is changes in CTC:

$$\Delta \mathrm{CTC}_{it} = \alpha + \beta \times \mathrm{DEF}_{it}^{\mathrm{CTC}} + \varepsilon_{it}, \tag{3}$$

where $\mathrm{DEF}_{it}^{\mathrm{CTC}}$ is the financing deficit for the first breakpoint for firm i at time t, and ε_{it} is an error term. The breakpoint is identified using the Andrews (1993) and the Andrews and Ploberger (1994)

breakpoint tests using the RATS 8.1 statistical package.[14] Once this first breakpoint is found, it is imposed on the regression using dummy variables where $D_{it}^{\mathrm{CTC},b} = 1$ if the observation is below the breakpoint and zero if it is above the breakpoint. Similarly, $D_{it}^{\mathrm{CTC},a} = 1$ for observations above the breakpoint and zero otherwise.

The following regression is then estimated:

$$\Delta\mathrm{CTC}_{it} = \alpha_b^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},b} + \beta_b^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},b} \times \mathrm{DEF}_{it}^{\mathrm{CTC}} + \alpha_a^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},a} + \beta_a^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},a} \times \mathrm{DEF}_{it}^{\mathrm{CTC}} + \varepsilon_{it}. \quad (4)$$

The predictions of pecking order financing are then given by the following two statements:

- There exists a breakpoint between CTC and other financing sources,
- and $\beta_b^{\mathrm{CTC}} = 1$, $\beta_a^{\mathrm{CTC}} = 0$, and $\alpha_b^{\mathrm{CTC}} = 0$.

To obtain a breakpoint for changes in the second funding source, BL, the following regression is estimated:

$$\Delta\mathrm{BL}_{it} = \alpha + \beta \times \mathrm{DEF}_{it}^{\mathrm{BL}} + \varepsilon_{it}, \quad (5)$$

where $\mathrm{DEF}_{it}^{\mathrm{BL}}$ is defined as $\mathrm{DEF}_{it}^{\mathrm{CTC}} - \Delta\mathrm{CTC}_{it}$ and again sorted. For the second funding source, after the breakpoint has been discovered, Equation (4) is modified so that:

$$\Delta\mathrm{BL}_{it} = \alpha_b^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},b} + \beta_b^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},b} \times \mathrm{DEF}_{it}^{\mathrm{BL}} + \alpha_a^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},a} + \beta_a^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},a} \times \mathrm{DEF}_{it}^{\mathrm{BL}} + \varepsilon_{it}. \quad (6)$$

This procedure is repeated for the other funding sources, but since unlisted firms do not issue external equity, there is no fifth breakpoint between OD and external equity.

Table 5. Tests for unknown breakpoints.

	Type of test			
	Andrews (1993)		Andrews and Ploberger (1994)	
Financing source (j)	Test value	P-value	Test value	P-value
	Using entire sample			
CTC	10.1621	0.0887	2.8844	0.0698
BL	66.3959	0.0001	28.9150	0.0001
OI	2.6277	0.9369	0.3641	0.9601
ETC	10.8610	0.0668	3.9440	0.0233
OD	1.6336	0.9998	0.6135	0.7762

Notes: Andrews (1993) and Andrews and Ploberger (1994) tests for unknown breakpoints are applied to the following model:

$$\Delta j_{it} = \alpha + \beta \times \mathrm{DEF}_{it}^{j} + \varepsilon_{it}.$$

Initially, the five possible funding sources are $j =$ CTC, BL, loans from OI, ETC, and OD. The funding deficit for the first financing source is $\mathrm{DEF}_{it}^{\mathrm{CTC}} =$ internal generated cash flows – investments – changes in working capital – changes in equity, as defined in Equation (2). Financing deficits for subsequent funding sources are defined as the funding deficit for the previous funding source minus the change in funds obtained from that source.
Robust standard errors are used. P-values are calculated as in Hansen (1997).

Table 5 provides results from the breakpoint tests that confirm pecking order financing predictions of breakpoints between funding sources. The breakpoint between changes in CTC and BL is significant at the 0.01% level, while a break between changes in loans from OI versus changes in ETC is significant at about the 2% level. There do not appear to be significant breakpoints between changes in BL and changes in loans from OI, nor is there much difference between the two highest cost sources of financing – changes in ETC and OD. Therefore, throughout the remainder of the paper, the two most expensive sources of credit will be grouped together and labeled as EC.

The next step is to test the predictions of pecking order financing:

- $\beta_b = 1$ and $\beta_a = 0$.

The following equation system is estimated by seemingly unrelated regressions (SUR):[15]

$$\begin{aligned}
\Delta\mathrm{CTC}_{it} &= \alpha_b^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},b} + \beta_b^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},b} \times \mathrm{DEF}_{it}^{\mathrm{CTC}} + \alpha_a^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},a} + \beta_a^{\mathrm{CTC}} \\
&\quad \times D_{it}^{\mathrm{CTC},a} \times \mathrm{DEF}_{it}^{\mathrm{CTC}} + \varepsilon_{it}, \\
\Delta\mathrm{BL}_{it} &= \alpha_b^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},b} + \beta_b^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},b} \times \mathrm{DEF}_{it}^{\mathrm{BL}} + \alpha_a^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},a} + \beta_a^{\mathrm{BL}} \\
&\quad \times D_{it}^{\mathrm{BL},a} \times \mathrm{DEF}_{it}^{\mathrm{BL}} + \varepsilon_{it}, \\
\Delta\mathrm{OI}_{it} &= \alpha_b^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},b} + \beta_b^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},b} \times \mathrm{DEF}_{it}^{\mathrm{OI}} + \alpha_a^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},a} + \beta_a^{\mathrm{OI}} \\
&\quad \times D_{it}^{\mathrm{OI},a} \times \mathrm{DEF}_{it}^{\mathrm{OI}} + \varepsilon_{it}, \\
\Delta\mathrm{EC}_{it} &= \alpha_b^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},b} + \beta_b^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},b} \times \mathrm{DEF}_{it}^{\mathrm{EC}} + \alpha_a^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},a} + \beta_a^{\mathrm{EC}} \\
&\quad \times D_{it}^{\mathrm{EC},a} \times \mathrm{DEF}_{it}^{\mathrm{EC}} + \varepsilon_{it}.
\end{aligned}$$

Again, the superscripts denote the four sources of debt (j = CTC, BL, OI, and EC) and the dependent variables are changes in the financing sources. The funding deficit for the first of the four financing sources for firm i at time t, as defined in Equation (2), is $\mathrm{DEF}_{it}^{\mathrm{CTC}}$ = internal generated cash flows – investments – changes in working capital – changes in equity. For the second funding source, $\mathrm{DEF}_{it}^{\mathrm{BL}} = \mathrm{DEF}_{it}^{\mathrm{CTC}} - L_{it}^{\mathrm{CTC}}$, and subsequent financing deficits are defined as the funding deficit for the previous funding source minus the change in funds obtained from that source. The notational superscripts a and b for the dummy variables again denote observations above or below the breakpoint. Thus, $D_{it}^{j,b} = 1$ for observations below the breakpoint for funding source j, while $D_{it}^{j,a} = 1$ for observations above the same breakpoint.

The null hypothesis, which would fail to reject pecking order financing, is given by:

$$\begin{aligned}
\beta_b^{\mathrm{CTC}} = \beta_b^{\mathrm{BL}} = \beta_b^{\mathrm{OI}} = \beta_b^{\mathrm{ETC}} = \beta_b^{\mathrm{OL}} = 1, \\
\beta_a^{\mathrm{CTC}} = \beta_a^{\mathrm{BL}} = \beta_a^{\mathrm{OI}} = \beta_a^{\mathrm{ETC}} = \beta_a^{\mathrm{OL}} = 0, \\
\alpha_b^{\mathrm{CTC}} = \alpha_b^{\mathrm{BL}} = \alpha_b^{\mathrm{OI}} = \alpha_b^{\mathrm{ETC}} = \alpha_b^{\mathrm{OL}} = 0.
\end{aligned}$$

In Table 6, the coefficient restrictions are soundly rejected at the 0.05% significance level or higher. Thus, there exist breakpoints between funding sources as predicted by pecking order financing, but firms do not exhaust each funding source before moving on to the next most preferred funding source.

Table 6. Tests of pecking order theory.

	Dependent variables			
	Δ CTC	Δ BL	Δ OI	Δ ETC
Constant before break α_b^j	−0.0041	−0.0235	−0.0024	−0.0004
	(−1.1779)	(−9.5787)	(−2.0363)	(−0.396)
Constant after break α_a^j	0.0044	0.0236	0.0098	0.0137
	(3.7757)	(10.0739)	(2.8687)	(3.5877)
DEF before break β_b^j	0.0295	0.2961	0.1349	0.5034
	(1.4778)	(19.8174)	(10.5931)	(50.2416)
DEF after break β_b^j	0.0157	0.2796	0.0860	0.4597
	(1.6652)	(20.0887)	(4.7461)	(29.5702)

Notes: The following system of equations is estimated using SUR:

$$\Delta \mathrm{CTC}_{it} = \alpha_b^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},b} + \beta_b^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},b} \times \mathrm{DEF}_{it}^{\mathrm{CTC}} + \alpha_a^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},a} + \beta_a^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},a} \times \mathrm{DEF}_{it}^{\mathrm{CTC}} + \varepsilon_{it},$$

$$\Delta \mathrm{BL}_{it} = \alpha_b^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},b} + \beta_b^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},b} \times \mathrm{DEF}_{it}^{\mathrm{BL}} + \alpha_a^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},a} + \beta_a^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},a} \times \mathrm{DEF}_{it}^{\mathrm{BL}} + \varepsilon_{it},$$

$$\Delta \mathrm{OI}_{it} = \alpha_b^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},b} + \beta_b^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},b} \times \mathrm{DEF}_{it}^{\mathrm{OI}} + \alpha_a^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},a} + \beta_a^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},a} \times \mathrm{DEF}_{it}^{\mathrm{OI}} + \varepsilon_{it},$$

$$\Delta \mathrm{EC}_{it} = \alpha_b^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},b} + \beta_b^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},b} \times \mathrm{DEF}_{it}^{\mathrm{EC}} + \alpha_a^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},a} + \beta_a^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},a} \times \mathrm{DEF}_{it}^{\mathrm{EC}} + \varepsilon_{it}.$$

The dependent variables are changes in the four funding sources: j = CTC, BL, loans from OI, and EC, which include ETC and OD. The funding deficit for the first financing source is $\mathrm{DEF}_{it}^{\mathrm{CTC}}$ = internal generated cash flows – investments – changes in working capital – changes in equity. Financing deficits for subsequent funding sources are defined as the deficit for the previous funding source minus the change in funds obtained from that source. The dummy variable $D_{it}^{j,b}$ is equal to one below the breakpoint for each funding source j, and zero above that point and vice versa for $D_{it}^{j,a}$. The t-statistics are in parentheses below the parameters. Tests of the predictions of the pecking order theory:

$$\beta_b^{\mathrm{CTC}} = \beta_b^{\mathrm{BL}} = \beta_b^{\mathrm{OI}} = \beta_b^{\mathrm{ETC}} = 1,\ \chi^2(4) = 10185.14 \text{ with significance level } 0.0000,$$

$$\beta_a^{\mathrm{CTC}} = \beta_a^{\mathrm{BL}} = \beta_a^{\mathrm{OI}} = \beta_a^{\mathrm{ETC}} = 0,\ \chi^2(4) = 1294.69 \text{ with significance level } 0.0000,$$

$$\alpha_b^{\mathrm{CTC}} = \alpha_b^{\mathrm{BL}} = \alpha_b^{\mathrm{OI}} = \alpha_b^{\mathrm{ETC}} = 0,\ \chi^2(4) = 19.90 \text{ with significance level } 0.0005.$$

Since SUR is used to test the restrictions, no R^2 is presented.

While the evidence above fails to support a literal version of pecking order financing, our data sample includes several firms with negative financing deficits for one or more funding sources. To check the robustness of our results, we repeat the analysis for only those firms with positive funding deficits for each funding source. The results in Tables 7 and 8 are derived from estimation of the four funding source equations using ordinary least squares (OLS) regression rather than SUR to maintain a reasonable sample size.[16] As given in Table 7, the breakpoint between changes in funding from internal equity and CTC is insignificant. This may occur because the group of firms in this subsample mostly takes advantage of the discounts offered by trade credits. Once again there is a strong significant breakpoint between CTC and BL and an insignificant break between the use of BL and loans from OI.[17] The break between changes in funding from OI versus the use of EC is significant at the 0.01% level – reiterating the case that most firms avoid the use of expensive financing whenever possible.

The restrictions implied by pecking order financing on the positive financing deficit firms are given in Table 8. The restrictions are strongly rejected at the breakpoint between changes in CTC and changes in BL and at the breakpoint between changes in loans from OI and changes in ETC.

Table 7. Tests for unknown breakpoints for companies with positive financing deficits.

	Type of test			
	Andrews (1993)		Andrews and Ploberger (1994)	
Financing source (j)	Test value	P-value	Test value	P-value
Using only observations with positive funding deficits				
CTC	8.3168	0.1823	1.4524	0.3254
BL	46.6343	0.0001	19.6642	0.0001
OI	6.9421	0.3002	1.1132	0.4675
EC	40.0153	0.0001	15.8207	0.0001

Notes: Andrews (1993) and Andrews and Ploberger (1994) tests for unknown breakpoints are applied to the following model:

$$\Delta j_{it} = \alpha + \beta \times \mathrm{DEF}_{it}^{j} + \varepsilon_{it}.$$

The four funding sources are j = CTC, BL, loans from OI, and EC, which include ETC and OD. The funding deficit for the first financing source is $\mathrm{DEF}_{it}^{\mathrm{CTC}}$ = internal generated cash flows – investments – changes in working capital – changes in equity, as defined in Equation (2). Financing deficits for subsequent funding sources are defined as the funding deficit for the previous funding source minus the change in funds obtained from that source.
Robust standard errors are used. P-values are calculated as in Hansen (1997).

The restrictions at the other two breakpoints between changes in internal equity and changes in CTC, and between changes in BL and changes in loans from OI provide mixed results. Some restrictions are rejected, while others are not. Nevertheless, the results from the positive financing deficit firms are similar to those from the entire sample – supporting the robustness of the previous results.

Most of the existing empirical evidence in the literature in favor of the pecking order theory comes from two observations based on *listed firms*. Under the basic pecking order theory, we expect to observe more debt financing than external equity financing. Based on Myers (2001), firms world-wide seldom make use of seasoned equity offerings to raise capital. The second observation is that under a literal interpretation of pecking order theory, the amount of debt financing should increase dollar for dollar with a firm's need for external financing. Shyam-Sunder and Myers (1999) tested this proposition on a small sample of primarily large listed firms and did not reject the pecking order theory. However, both of these propositions have been challenged by other authors. Fama and French (2005) estimated that more than half of their sample firms used external equity. Frank and Goyal (2003) also found that many firms use external equity and in line with our results, they showed that firms do not use debt dollar for dollar to finance new projects. As we do with our sample of unlisted Portuguese SMEs, Frank and Goyal (2003) also reject the literal version of the pecking order theory using small *listed* US firms. Relative to the country-specific tests of the pecking order, such as Yu and Aquino (2009), our results are less favorable to a strict interpretation of pecking order financing. Our results are broadly consistent with the Leary and Roberts (2010) loose interpretation of pecking order theory since Portuguese firms generally proceed with financing along the pecking order, even if they do not totally exhaust each source before moving on to the next higher cost funding source. We hypothesize that such behavior may be consistent with maintaining flexibility in financing. That is, a firm can meet small changes in required funding amounts by more or less intensively using existing funding sources, rather than by moving up or down the pecking order.

Table 8. Tests of pecking order predictions for companies with positive funding deficits.

	Dependent variables			
	Δ CTC	Δ BL	Δ OI	Δ ETC
Constant before break α_b^j	−0.0032	0.0002	0.0003	−0.0074
	(−0.8994)	(0.077)	(0.1413)	(−6.8059)
Constant after break α_a^j	0.0056	0.0503	0.0051	0.0957
	(2.2994)	(3.8505)	(1.2024)	(2.6314)
DEF before break β_b^j	0.7284	0.4956	0.0485	0.5302
	(3.0028)	(15.2055)	(0.6325)	(17.6144)
DEF after break β_b^j	0.0163	0.1372	0.1073	0.2373
	(0.8198)	(2.6079)	(3.4729)	(1.7252)
Hypothesis tests	Probability levels			
$\alpha_b^j = \alpha_a^j$	0.0489	0.0001	0.2974	0.0046
$\beta_b^j = \beta_b^j$	0.0034	0.0001	0.4774	0.0375
$\beta_b^j = 1, \beta_a^j = 0$	0.3818	0.0001	0.0001	0.0001
R^2	0.0018	0.1374	0.03782	0.3989

Notes: The following equations are estimated by OLS regressions:

$$\Delta \mathrm{CTC}_{it} = \alpha_b^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},b} + \beta_b^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},b} \times \mathrm{DEF}_{it}^{\mathrm{CTC}} + \alpha_a^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},a} + \beta_a^{\mathrm{CTC}} \times D_{it}^{\mathrm{CTC},a} \times \mathrm{DEF}_{it}^{\mathrm{CTC}} + \varepsilon_{it},$$

$$\Delta \mathrm{BL}_{it} = \alpha_b^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},b} + \beta_b^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},b} \times \mathrm{DEF}_{it}^{\mathrm{BL}} + \alpha_a^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},a} + \beta_a^{\mathrm{BL}} \times D_{it}^{\mathrm{BL},a} \times \mathrm{DEF}_{it}^{\mathrm{BL}} + \varepsilon_{it},$$

$$\Delta \mathrm{OI}_{it} = \alpha_b^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},b} + \beta_b^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},b} \times \mathrm{DEF}_{it}^{\mathrm{OI}} + \alpha_a^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},a} + \beta_a^{\mathrm{OI}} \times D_{it}^{\mathrm{OI},a} \times \mathrm{DEF}_{it}^{\mathrm{OI}} + \varepsilon_{it},$$

$$\Delta \mathrm{EC}_{it} = \alpha_b^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},b} + \beta_b^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},b} \times \mathrm{DEF}_{it}^{\mathrm{EC}} + \alpha_a^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},a} + \beta_a^{\mathrm{EC}} \times D_{it}^{\mathrm{EC},a} \times \mathrm{DEF}_{it}^{\mathrm{EC}} + \varepsilon_{it}.$$

The dependent variables are changes in the four funding sources: j = CTC, BL, loans from OI, and EC, which include ETC and OD. The funding deficit for the first financing source is $\mathrm{DEF}_{it}^{\mathrm{CTC}}$ = internal generated cash flows – investments – changes in working capital – changes in equity. Financing deficits for subsequent funding sources are defined as the deficit for the previous funding source minus the change in funds obtained from that source. The dummy variable $D_{it}^{j,b}$ is equal to one below the breakpoint for each funding source j, and zero above that point and vice versa for $D_{it}^{j,a}$. The t-statistics are in parentheses below the parameters. The equations are estimated using OLS due to small size of sample. The full sample in Table 6 was estimated using SUR.

6. Conclusion

This paper has tested for pecking order financing using a modified version of the Shyam-Sunder and Myers (1999) test that examines the impact of the financing deficit on changes in debt. Our research has contributed to the literature on capital structure because we have adopted an improved version of this test for pecking order theory and because we have extended the analysis to consider multiple classes of debt, rather than the traditional choices between internal financing, debt as a broad category, and external equity. We have performed Andrews (1993) and Andrews and Ploberger (1994) tests to identify breakpoints between various financing sources and then used these breakpoints to estimate a kinked relationship between the financing deficit and each change in funding source. We support a loose interpretation of pecking order financing because we have found breakpoints between internal equity, CTC, loans from banks and OI, and expensive financing sources involving ETC and OD. However, we reject the second set of restrictions involving specific values for slope and intercept coefficients. Our results suggest that medium-sized Portuguese firms

may follow a loose pecking order based on cost of funding, but they also try to maintain some flexibility in terms of financing. They do not exhaust each lower cost funding source before moving on to the next higher funding source in the pecking order.

Serrasqueiro (2011, 34) has stated that

> it would be advisable for policy makers and creditors to create special lines of credit, with advantageous terms, so that Portuguese service SMEs, when internal finance is insufficient, can finance more effectively the growth opportunities and the strategies for diversification.

Because Portuguese manufacturing firms value maintaining financial flexibility, our results support similar policy implications. Improved access to credit (possibly backed by the government) would allow private firms to more fully utilize each lower cost source of funding before moving on to the next funding source in the pecking order. Such a policy would decrease costs of production and increase profitability in this important sector of the economy.

Notes

1. Prior to adopting the Euro in 1998, the Portuguese financial market was less developed than much of Europe. Since complete financial integration into the European Union occurred gradually after 1998, we felt that data for unlisted firms until about 2000 still represented firms with highly asymmetric information. Also, in contrast to alternative data from developing nations that also might be expected to support pecking order theory, our Portuguese firms appear to be somewhat free of data errors that might bias the results.
2. Following the asymmetric information argument of Myers and Majluf (1984), one expects greater information asymmetries for small firms relative to large firms, for unlisted relative to listed firms, and for firms in countries with less mature financial markets. In line with these expectations, Bharath, Pasquariello, and Wu (2009) argue that most studies that reject pecking order behavior use data from highly developed markets where there is little asymmetric information.
3. Our sample was limited to manufacturing firms to maintain a relatively homogenous group of firms that made use of all categories of debt financing including trade credits. Service sector firms might be more likely to observe pecking order financing based on the work of Serrasqueiro (2011), but inclusion of this sector would have made the sample less homogeneous.
4. The European Union definition of SME is a firm having fewer than 250 employees, assets under 43 million euros, and sales under 50 million euros. In contrast, our sample contains a few slightly larger firms. However, more significantly, we limit the analysis to firms with 100 or more employees – thereby eliminating micro enterprises. Thus, our sample consists of medium-sized private manufacturing firms and it does not fit the broader definition of SME.
5. Note that only 10 years of data are used in the remainder of the paper. Our test of pecking order financing is based on changes in debt which cannot be calculated for the year 1990 (first year of the sample).
6. Note that the monetary amount of BL far exceeds the value of trade credit. Even though paid on time trade credit is cheaper than bank financing, the amount of trade credit available is limited by the amounts of goods and services delivered to a firm. So, firms make greater use of loans, even though they would prefer trade credit to loans in terms of cost.
7. Based on a phone survey to randomly selected firms in each industry, there is some variance across firms and industries. The 2 net 30 example for trade credits is representative of Portuguese contracts. Informally, however, many firms may have a grace period involving no penalty (and no discount) if they pay after 30 days, but before legal proceedings are initiated against delinquent accounts.
8. Eurofactor (2006) reports that 22% of Portuguese companies imposed late payment charges in 2005 and that 93% of these companies actually collected late payment penalties.
9. Such numbers are similar to those reported for the UK by Poutziouris, Michaelis, and Soufani (2005).
10. Details about these calculations are presented in Table A1.
11. We have first scaled all variables by total assets and then assumed that all firms in an industry have the same breakpoint. Without scaling, we would have to limit the sample to firms to those of similar sizes in each industry to make meaningful comparisons.
12. We only have data for, at most, 10 years for each firm. Thus, it is not possible to test for and estimate breakpoints for each firm in the sample.

13. For example, a firm is not expected to fund more of the financing deficit from CTC than the amount of trade credits available to that firm.
14. The Andrews–Ploberger test permits the identification of multiple breakpoints simultaneously, but pecking order theory imposes sequential financing choices. Thus, each breakpoint is estimated individually and sequentially after discovering the first breakpoint.
15. We have chosen to estimate the system with SUR rather than with panel estimators (such as a fixed effects model) to emphasize the jointness of the financing decision across all debt sources. Also, there is little in capital structure theory suggesting that there should be fixed effects for our sample of firms.
16. Using SUR involves deleting any firm with a negative funding deficit for any funding source.
17. The coefficient for β_b^{CTC} is closer to one than for any of the other funding sources. The significance of the coefficient may appear to strongly support pecking order theory, but the small R^2 statistic for this equation makes it difficult to draw overall conclusions. Perhaps, CTC are treated as an exogenous source of funds and not part of the pecking order, which might explain the low R^2.

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Appendix

First, an estimate of the number of credit days is given by:

$$\text{Credit days} = \frac{\text{Trade credits}}{\text{Cost of goods sold}/365},$$

where trade credits are obtained from the balance sheet at the end of each fiscal year and cost of goods sold is an annual flow measure taken from the income statement. The number of credit days is a point estimate based on the value of trade credits at the end of the fiscal year. This number may, or may not, be a good estimate of the average amount of trade credits throughout the year. If there is seasonality in the purchase of goods and services, then the estimate will be a function of the time of measurement. Consider an extreme example of a toy store that always pays at the due date of say 90 days and stock for the Christmas trade in November. If the fiscal year ends in November, then the amount of trade credits is very large and the estimate of credit days will be correspondingly large; whereas if the fiscal year ends in February, then the estimate of trade credits will be very small. Even in a sample where all firms pay at the due date, the point estimate will show significant variation due to random or seasonal variation in the amount of trade credits depending on the time of measurement.

The second estimate we need is the standard contract terms in the industry. We have only a point estimate of the actual credit days at the end of the fiscal year for each company. There are two factors influencing the number of actual credit days. The first is seasonality as discussed above. If the firm pays on time, then our point estimate will fluctuate randomly around the number of days specified in the contract (a normal or symmetric distribution). This suggests using the average number of actual credit days for each industry as an estimate of the normal contract for the industry. However, the sample also includes firms that delay payments on the trade credit. The existence of firms with late payments influences the right-hand side of the distribution and makes the distribution appear log-normal. The mean and median number of days in the sample is influenced by the number of firms in the sample that delay payment and it is not a good estimate of the terms of the contract. (If one is willing to assume a log-normal distribution, then it is possible to obtain an estimate of the first moment of the distribution from the average. However, here, we choose to use a simpler method that does not rely on the properties of the distribution.) Instead, we assume that most firms pay on time, that is, at the end of the contract and they claim the discount. We use the most common number of actual credit days as an estimate of the number of credit days written into the contract for a given industry. The problem of seasonality and randomness in the estimate of actual credit days still exists. As shown in the toy store example above, the number of credit days estimated from the

balance sheet may exceed the number of days specified in the contract even if the firm pays on time. Thus, the influence of seasonality and randomness needs to be removed to isolate the firms with late trade credit payments. Since the right hand of the distribution is influenced by the number of firms with late payments, it is not possible to use the entire distribution to estimate the variance of the number of actual credit days for firms that pay on time. However, it is possible to use the left-hand side of the distribution because late payment firms are not found there.

The semi-variance is estimated using the left-hand side and converted to the variance for the distribution by multiplying by 2:

$$\hat{\sigma} = \sqrt{\frac{2}{T^-}\left(\sum_{t}^{T^-} \text{Min}(0;\ \text{actual credit days} - \text{contract days})^2\right)}.$$

It is now possible to estimate CTC and ETC for each firm in the sample:

$$\text{if actual credit days} > \text{contract credit days} + 1.96\hat{\sigma} \Longrightarrow \text{Expensive trade credit,}$$

$$\text{if actual credit days} < \text{contract credit days} + 1.96\hat{\sigma} \Longrightarrow \text{Cheap trade credit.}$$

The average number of actual credit days for the entire sample is provided in Figure 1. The median number of days is 92 and the average is 106. The mean is larger than the median reflecting that the distribution is skewed to the right due to late payments. Eurofactor (2006) reports an average number of credit days of 83 days for 2005 and that the number of credit days has declined over time. *A priori*, we would expect most firms to exploit the discount and pay on time. Thus, an estimate of the due date can be obtained by looking at the most common number of credit days (the tallest column in the figure). For the entire sample, this is between 75 and 85 days. For 2005, Eurofactor (2006) reports an average number of credit days from contracts of 53 – so, there has been a decrease in actual and contract credit days over time.

The estimate for the contract days for each industry in Table A1 and is based on the most common number rounded to the nearest 10 days (e.g. $30, 40, 50, \ldots$). (Ng, Smith, and Smith (1999) report that the normal contract issued by listed firms (Compustat firms) in the US is 2–10 net 30, that is a 2% discount is received if paid within 10 days otherwise payment has to be made within 30 days.) The standard deviation ranges from 13 to 52 days. The cut-off days for cheap credits (i.e. if the number of credit days is larger than this number of days, then the trade credits are defined as being expensive) is estimated by 1.96 times the estimate of the standard deviation plus the estimated value of the contract values (most common value). In Table A1, values range from 67 days to 212 days.

An estimate of the amount of CTC is then obtained by comparing the actual credit days with the estimated days for the industry. If the actual number of credit days is below the estimated days for the industry, then all of the trade credits are classified as CTC. If the actual number of days is above the estimated industry norm, then all the trade credits are classified as expensive.

Table A1. Summary of evidence for estimating credit days in trade credit contracts.

Industry	Sample data: Median number of days	Sample data: Most common number of days	Estimate of number of credit days in a standard contract	Estimate of standard deviation of credit days	Cut-off number of credit days defining CTC and ETC
Food and drinks	60	35–45	40	13.6098	66.6752
Textiles and clothes	86	66–75	70	28.5422	125.9427
Wood and paper paste	95	85–95	90	34.5357	157.69
Chemical products	116	85–95	90	28.8522	146.5503
Heavy industry	108	75–85	80	18.6593	116.5722
Machinery production and equipment	106	105–115	110	52.1976	212.3073

Note: These estimates are used to distinguish between CTC and ETC.