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An Agency Model for Trade Credit Policy

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Abstract

This article proposes an agency model to explain the trade credit offer to clients. Our model is based on the existence of asymmetric information between sellers and buyers, which results in the appearance of two phenomena known as adverse selection and moral hazard. The former has already been explored by other authors, but not the latter, i.e., the possibility of the buyer not paying the provider. The results obtained indicate that days of sales outstanding of firms are positively related to adverse selection and negatively related to moral hazard. In order to test the moral hazard hypothesis, we use three variables: variable cost, demand elasticity and bad debts. Variable cost and demand elasticity present the expected relation, but bad debts only presents the negative expected relation at low levels, which suggests that when a firm presents high levels of bad debts the risk of the portfolio of clients is also high. In this case, the clients are more likely to present a low liquidity situation and consequently do not take advantage of the use of cash discounts. Traditional models are also tested and compared with the proposed model. We did not find evidence to support tax theory or to support the operational argument of transaction cost theory. We find weak evidence to support the liquidity theory, while the asymmetric information theory was confirmed. A comparison between the agency model proposed and traditional models concluded that the Agency model reached better results in the explanation of the subject of study.

Keywords: Trade Credit, Asymmetric Information, Adverse Selection, Moral Hazard
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1. INTRODUCTION

Trade credit is a very important source of financing for companies. Although it is an old practice, it is not completely understood. Numerous theories have been proposed to explain its existence and use, but none of them can provide a complete explanation of the topic. While some of the models are more consistent in the case of certain industries or categories of products others work better in a financially constrained environment.

Four types of explanation can be enumerated as follows: a model based on transactions costs arguments was proposed by Schwartz (1974); financial models were first suggested by Emery (1984); a tax based model was suggested by Brick and Fung (1984); and an asymmetric information model was suggested by Smith (1987).

This paper focuses on explaining trade credit proposing an agency model, based on the agency problem described by Jensen and Meckling (1976). We consider the relation between a firm and its clients an agency relation from which two observable facts arise: adverse selection and moral hazard. Adverse selection happens when there is ex-ante asymmetric information between buyers and sellers. In this case buyers do not know ex-ante the characteristics and quality of the goods that are being acquired. The moral hazard is the possibility of clients not paying, since there is ex-post asymmetric information.

Using a sample of UK manufacturing firms, we test the proposition that trade credit is explained by a trade-off between these two phenomena. Our results support the positive relation between adverse selection and trade credit and the negative relation between moral hazard and trade credit, the first relation is also consistent with asymmetric information theory. This result supports the agency model suggested.

Other authors have used the adverse selection problem to explain trade credit, but none of them have included the moral hazard. This is the main contribution of our research.

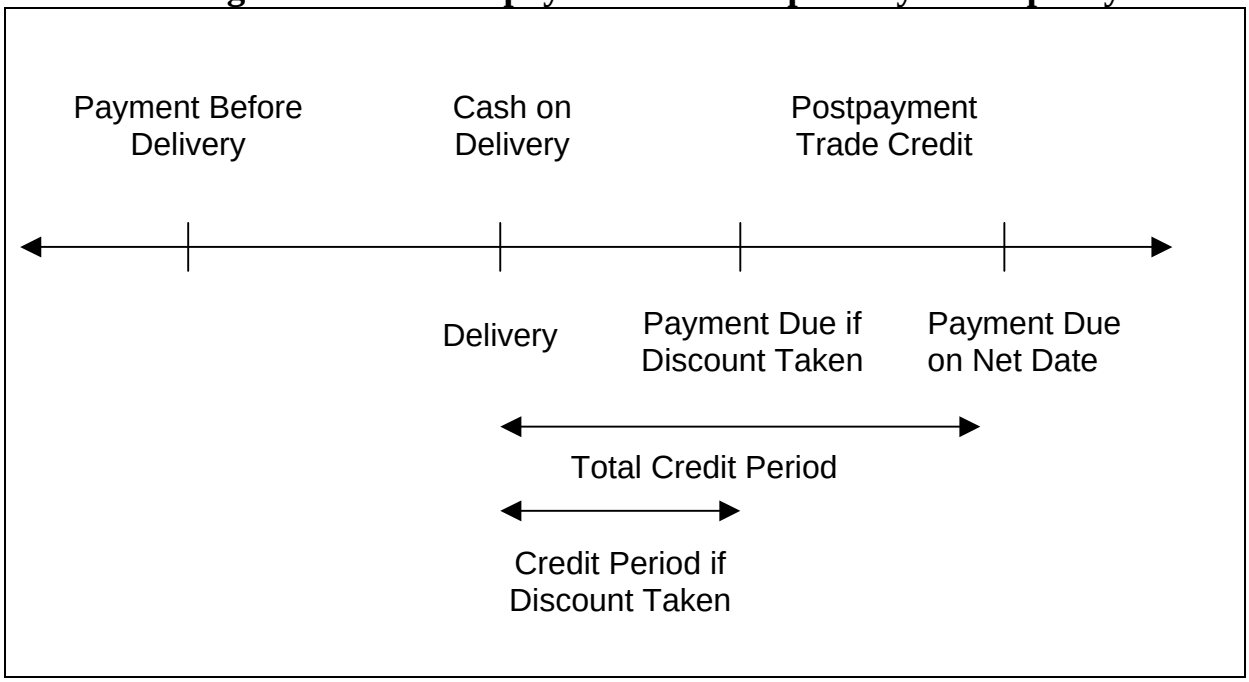
This paper is organized as follows. Section 2 describes the state of the art of the topic studied and summarizes the main theories and research on trade credit. Section 3 proposes an agency model and Section 4 describes the data and methodology used. Section 5 shows our interpretations for the results using univariate and multivariate tests to contrast the agency model and also test traditional models. In the last section we conclude and suggest some further research studies.

2. STATE OF THE ART

Trade credit is one of the oldest forms of corporate financing and it is still very important nowadays, it refers to financing provided by a seller to its buyer

(Wei and Zee, 1997). To understand the concept of trade credit it is important to know the range of alternative credit arrangements that can occur in trade. Depending on credit policy, payment can be made at different times. It can occur before delivery, on delivery or after delivery. In the last case, the seller can offer discounts for prompt payment or not, depending on trade arrangements. When payment does not occur before delivery or at delivery time, trade credit is being extended and the seller assumes the credit risk. Otherwise, trade credit is not being offered and the buyer assumes the risk. Figure 1 can better illustrate these situations.

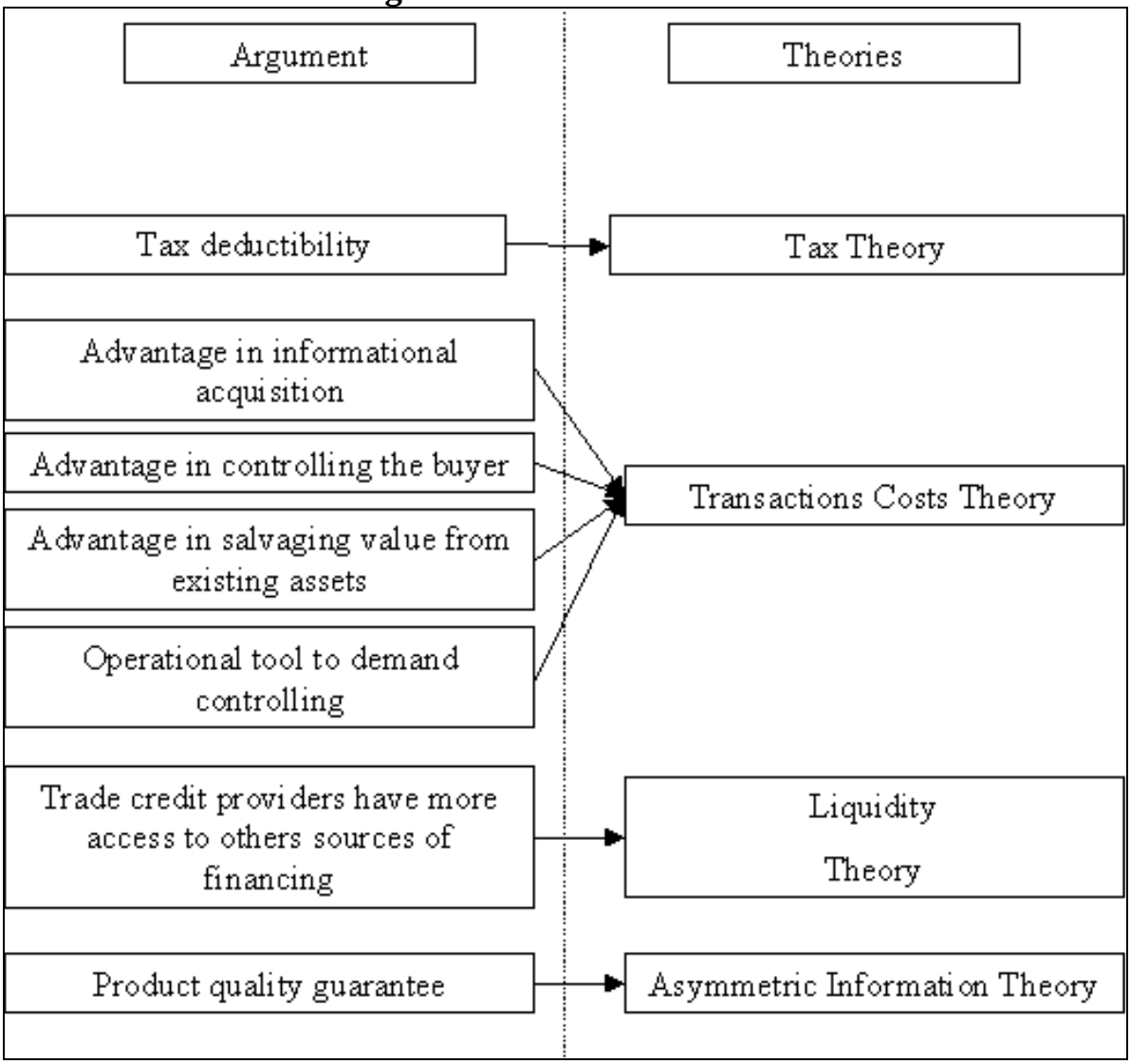
Figure 1: Different payment times implied by credit policy.



Note: Adapted from Ng, Smith and Smith (1999)

Although trade credit is a very useful source of resources for different kinds of firms, its explanation is not very clear yet, as pointed out by Long, Malitz and Ravid (1993). In the last three decades, many theories and models have appeared to explain trade credit. Most of these theories rely on market imperfections such as the existence of tax, transactions costs and asymmetric information, as shown in Figure 2. In the rest of this section we are going to detail each of those theories.

Figure 2.: Trade Credit Theories



2.1. Existence of tax

The decision to accept or not accept a credit depends on other possibilities of credit. A buyer must compare different alternatives to make sure which is the best choice. In trade between a seller and a buyer, a post payment can be offered, but it is not free, there is an implicit or an explicit interest rate included in the final price. Therefore, to find the best source of financing, the buyer must check out the real borrowing cost in other financing providers.

Brick and Fung (1984) suggest that tax must be considered in order to compare trade credit cost with other alternatives of financing. The main reason for this is that if buyers and sellers are in different tax brackets, they have different borrowing costs. This is true, since interests are tax deductible. An argument to reinforce this idea is that by offering trade credit, sellers can offer discounts for cash payment that are tax deductible as well.

The authors' hypothesis is that companies in a higher tax bracket tend to offer more credit than those in lower tax brackets; otherwise, buyers could borrow more cheaply directly from a financial institution and will prefer to buy at a lower cash price. Another conclusion is that firms allocated to a given industry and placed in a tax bracket below industry average cannot profit from offering trade credit. Brick and Fung (1984) even suggest that firms cannot both use and offer trade credit.

2.2. Transactions Cost Theory

First developed by Schwartz (1974), this theory conjectures that suppliers may have an advantage over traditional lenders in checking the real financial situation or the credit worthiness of their clients. Suppliers also have a better ability to monitor and force repayment of the credit. All these superiorities may give suppliers a cost advantage when compared with financial institutions. Three sources of cost advantages were cataloged by Petersen and Rajan (1997): advantage in information acquisition, in controlling the buyer and in salvaging value from existing assets.

The first source can be justified by the fact that sellers can get information about buyers faster and at lower cost because it is obtained in a normal course of business. That is, the frequency and the amount of the buyer's orders give suppliers a notion of the client's situation; the buyer's use of discounts for early payment may serve to alert the supplier of a weakening in the credit-worthiness of the buyer, and sellers usually visit customers more often than lenders. Smith, in his model (1987), concludes that in a two-part credit with high interest rate, those buyers that do not choose to take advantage of the discount can be interpreted as high risks, because they may be having financial difficulties. Depending on penalties for later payers, simple net terms can produce a similar sign.

The second source can be seen as the power of the seller to threaten buyers. In other words, in some cases there are just a few alternative suppliers for the needed product and, consequently, buyers have very restricted choice. In this case, suppliers can threaten to cut off future supplies if they note a reduction in the chances of repayment. Compared with providers, banks and other lenders do not have the same threat force. This advantage can become stronger when buyers only represent a small part of the provider's sales or the provider is part of a network and future community sanctions can be made, not only by one seller, but by a group, which makes this threat much stronger (Kandori, 1992). This hypothesis was empirically confirmed by McMillan and Woodruff (1999). Another interesting finding in this strand of literature was made by Petersen and Rajan (1997), whose empirical results suggest that debtors are less willing to repay a distressed seller. Their argument is that threats of cutting off future supplies, made by a supplier with financial problems, are not so credible.

The seller's ability to salvage values from existing assets is the third source of cost advantages. In the case of buyer default, the seller can seize the goods that are supplied, of course, financial institutions can reclaim the firm's assets as well. The difference between them is that as companies trading are very often from the same industry, the supplier already has a network to sell the goods and consequently repossessing and resale costs would be lower. Two interesting approaches related to this cost advantage were made by Mian and Smith (1992) and Petersen and Rajan (1997). The former posit that the more durable the goods, the better collateral they provide and the greater the credit offered by the suppliers. The latter point out that the extent to which the customers transform the product is also very important. The less they are transformed, the easier it will be for the provider to repossess and sell the asset using the same channel.

An important reflection must be made about goods value relativeness. Ng, Smith and Smith (1999) consider that the value of a product is relative to different institutions, i.e., if a product has more value as a collateral to a seller than to financial institutions, the seller may have cost advantage in recuperating the product and selling it again. In this situation, providers tend to offer cheaper credit than financial institutions because of the reduction of the credit risk.

Another study related to transaction cost theory was made by Emery (1987), and hypothesizes that there is a positive relation between demand variability and credit offered. The argument to support this idea is that as demand fluctuates, a company has two traditional reactions: production or price adjustment. The author believes that both are very costly and a better decision could be taken. The seller could change trade credit terms according to demand. Terms can be relaxed when demand drops and be tightened when demand increases. In this case, trade credit can be seen as an operational tool. Long, Malitz and Ravid (1993) obtained empirical evidence supporting this hypothesis. Their results show that firms with variable demand extend more trade credit than firms with stable demand.

2.3. Liquidity Theory

This theory suggests that credit rationed companies use more trade credit than those with normal access to financial intermediaries. The central point of this idea is that when there is a restricted monetary policy, the offer of trade credit can make up for the reduction of the credit offer from financial intermediaries. In accordance with this view, large firms, presenting good liquidity or better access to capital markets can finance those constrained by the policy.

Many approaches have tried to obtain empirical evidence to support this theory. Nielsen (1999) using small firms as a proxy for credit rationed companies found that in monetary contraction they react by borrowing more

from their suppliers. As a result, trade credit tends to be less used in countries where companies have good relations with banks.

As liquid firms are less likely to demand trade credit and more likely to offer it, a negative relation between buyer's access to other sources of financing and trade credit use is expected, as Petersen and Rajan (1997) find. Another expected negative association, also found by these authors is between proxies for the strength of bank relationships and trade credit demand.

2.4. Asymmetric information theory

Sellers, usually, do not know the real credit-worthiness of their buyers and also buyers do not have knowledge about goods quality. To solve the first problem, Smith (1987) suggests a model where sellers offer two-part credit terms because they can recognize potential defaults faster than financial intermediaries. And, as presented in Section 2.2, there are many other arguments proposing that providers have costs advantages in acquiring knowledge about a buyer's financial situation. But, what about the second problem? Smith also proposed that with asymmetric information about product quality, sellers offer trade credit to permit buyers to verify product quality before payment.

The reason that leads suppliers to extend this credit is that they have an immense interest in a customer's success, since they expect the client to buy more goods and service from them in the future. Although success of the buyer is important, the quality of the product sold is also crucial, and could determine new purchases. As a consequence, companies very often offer money-back guarantees as warranties as well.

Trade credit has some advantages when compared with money-back guarantees and warranties. First, in a case of money-back or warranties, if the seller is not in business any more, the buyer can be damaged. Second, when payment is made at the time of sale, a client, seeking the advantages of the money-back system, may try to convince the seller that the quality of the product is not as promised.

As pointed out by Smith (1987), one of the major proposals of trade credit is to allow clients to assess product quality prior to payment, although this is not true for some categories of product. Therefore, this theory works better in some industries whose product quality is unknown at the moment of purchase. If this idea is correct, trade credit will be higher in the trade of products where quality is indefinite at a prior moment and the purchase is not frequent. Otherwise, trade credit will be lower in trades of perishable items where acquisition is very frequent.

Many researchers have studied trade credit from this point of view, see for instance: Lee and Stowe (1993), Long Malitz and Ravid (1993), Deloof and Jegers (1996) and Wei and Zee (1997). In general, the main results of these authors are: i) Small firms tend to offer more trade credit than large firms, since

small firms still have to establish their reputation about product quality. ii) Firms with longer production cycles prolong their collection period, since they produce high-quality goods. iii) Firms selling products whose quality is difficult to measure extend long credit periods because customers must have enough time to assess quality. iv) Sellers of low quality goods may try to pass them off as high-quality goods. In this case, as the cost of extending trade credit increases, these companies will have less incentive to cheat on the information on quality.

2.5. What these models do not explain or why models are not complete

Although many theories have attempted, through different ways, to explain the existence of trade credit, they cannot provide a complete explanation of the topic. While some of the models are more consistent with the case of certain industries or categories of products others work better in a financially constrained environment. According to Frank and Maksimovic (1998) "*the existing theories show effects that may be important in specific circumstances, but they do not capture what seems to be central for explaining the wide-spread use of trade credit and the empirical patterns of its use"*. Let us check theory by theory and identify some inconsistencies or situations not very well explained.

Tax theory suggests that companies in high tax brackets tend to offer credit to those in low tax brackets. Many research studies have found empirical evidence to support this, but this explanation does not seem to be enough since it can not explain trade credit between companies situated in the same tax bracket.

If trade credit is an operational tool and exists to minimize transaction costs as in Ferris (1981), a reduction in the level of trade credit use would be expected since many improvements in transaction technologies have taken place. This reduction has not been observed.

Liquidity theory supposes that more constrained companies use more trade credit than those with easier access to financial intermediaries. This may be an explanation, but once more, does not seem to be enough since it does not explain why companies not financially constrained also use trade credit.

In the presence of asymmetric information, trade credit is offered to allow clients to check the real quality of the goods before payment, but traditional models only consider this phenomenon, called adverse selection, and forget another one that is the risk of goods not being paid for, the moral hazard.

3. AN AGENCY MODEL FOR TRADE CREDIT POLICY

The theories presented above are not able to explain the central point about why some products and services do not have credit or should be paid in cash. Because of this we proposed an agency model to explain trade credit from the supplier's point of view.

From the agency problem proposed by Jensen and Meckling (1976), we can consider the relation between a firm and its clients an agency relation from which two observable facts arise: adverse selection and moral hazard. Adverse selection occurs when there is ex-ante asymmetric information between providers and buyers. In this case, clients do not know ex-ante the characteristics and quality of the goods that are being acquired. As described in Section 2.4, this phenomenon has already been studied by other authors, but not the moral hazard, which consists of the possibility of the contractual relationship not being carried out by the client, facilitated by the ex-post asymmetric information. The worst consequence of this is to generate bad debts.

The main difference between this agency model and other models that attempt to explain trade credit assuming the existence of asymmetric information is the inclusion of moral hazard. Thus we define a function to explain trade credit as follows: $DSO=\phi(\varpi,\mu)$, where DSO is the day of sales outstanding, ϖ is the cost of adverse selection and μ the moral hazard. From this function we expect ϖ to be positively related to DSO and μ to be negatively related.

We compute a proxy for days of sales outstanding (DSO) as the natural logarithm of the average collection period measured by accounts receivable divided by daily sales.

To proxy the adverse selection phenomenon, we find some variables in the literature that have been used for this purpose. Representing technical industries we construct a dummy variable SEC which takes the value of one if the goods sold need a significant time to verify their quality level, and zero otherwise. To classify each company in our sample, we follow Titman and Wessels (1988) defining technical industries as those in SIC 3400-3999[1]; we expect SEC to be positively related to DSO variable. To classify firms whose products are easy to observe (perishable), we follow Long, Malitz and Ravid (1993) and construct another dummy variable PER which takes the value of one if the company's products are considered perishable, those in SIC code between 2000 and 2199 (food and agricultural), and zero otherwise. We expect this variable to be negatively related to DSO. To proxy firm reputation we use the variable SIZE, measured as the natural logarithm of a firm's total assets; we expect a negative correlation between SIZE and DSO. With the aim of proxying the fixed assets of the firms we calculate FIX as 1-(Fixed Assets/Total Assets). This variable has been used by Prowse (1990) who suggests that the greater the proportion of fixed assets in a firm, the smaller the asymmetric information problem, thus we expect it to be directly related to DSO. Another alternative proxy for the adverse selection is EBIT (a measure for supplier results); the bigger it is, the smaller the consequences of adverse selection to the buyer. The EBIT variable is calculated by dividing earnings before interest and taxes for total assets; this variable is

[1] Long, Malitz and Ravid (1993) used the same classification.

expected to be negatively correlated to DSO. The last variable we use to proxy for the adverse selection is DPA[2] which consists of the days to pay accounts receivable. This variable is used because high quality firms may increase the cost of trade credit by financing their purchases. The expected relation with DSO is positive.

The above described adverse selection phenomenon gives rise to our first hypothesis:

Hypothesis 1: The greater the presence of adverse selection the greater the trade credit offer. Therefore we expect days of sales outstanding to be directly related to days to pay accounts payable and those sectors producing high quality goods and inversely related to firms earnings, firm size, fixed assets and those sectors producing perishable goods.

As regards proxy moral hazard we suggest three different variables: VCO (variable cost); BDE (bad debts provision); and DEL (demand elasticity). We base our suggestion of those proxies on Oh (1976). In accordance with this author, the decision to change a current credit policy to a new one depends on whether the marginal profitability is greater than or equal to the associated marginal opportunity cost. But which benefits and costs are related to trade credit and must be compared? When a firm decides to extend its credit policy it is probably expecting a sales increase and hence will assume new costs such as collection costs, bad debt losses and variable costs. Thus, the credit policy decision involves a tradeoff between profits on the marginal credit sales and the marginal costs.

According to trade credit literature, the more extensive the credit offer, the greater the amount of bad debt losses the seller will support. To mitigate this problem, companies have incentives to offer bigger cash payment discounts. These discounts must be attractive enough to convince even the risky buyer to pay sooner, because if this occurs, it may reduce the possibility of bad debt losses since it restricts the time available to buyers to develop more problems. We proxy for the bad debt using the balance data provision-other[3], which includes provision for bad debts and losses, divided by total assets. This variable is expected to be negatively related to DSO.

When trade credit is extended, if the buyer does not pay, the provider will support all costs generated by the new sales. Therefore, the damage caused by

[2] We take this variable as calculated by Compustat Global Vantage as follows: accounts payable divided by the sum of inventories plus cost of goods sold plus depreciation and amortization minus the previous value for inventories minus depreciation and amortization. This total is divided by 360.

[3] This item also includes contingencies, provision for employee profit sharing, provision for fluctuation and valuation of investments, provision for foreign exchange loss and provision for taxes.

the moral hazard will be greater, since a buyer's default is the worst consequence. For those reasons we expect that the greater the variable cost, the more rigid the credit policy will be. To proxy for this we use the cost of goods sold divided by total assets. We expect VCO to be inversely related to DSO.

The last factor we use to proxy for the moral hazard phenomenon is demand elasticity. According to Borde and Mcarty (1998), an early payment discount is actually a price reduction and if buyers are price elastic, cash discounts may generate greater demand for the firm's products. Following their argument, and the concept of time value of money, a long period of payment can be considered a price reduction as well, and in this case it can generate aggregated demand. This revenue coming from the new clients resultant from a less rigid credit policy can compensate or mitigate some risks assumed by the provider such as the bad debts and the variable costs. Therefore, the bad consequences of moral hazard will decrease when a firm's clients are demand elastic. We proxy for DEL using the differences between sales as a proportion of total assets in $year_t$ and sales as a proportion of total assets in $year_{t-1}$, divided by the differences between the average collection period in $year_t$ and average collection period in $year_{t-1}$. We expect DEL to be negatively related to DSO. Equation 1 shows our measure for the moral hazard as a function of three components.

$$MORALHAZARD = \phi(DEL, VCO, BDE) \qquad (1)$$

Our second hypothesis is based on the above described moral hazard phenomenon.

Hypothesis 2: The greater the moral hazard consequences, the shorter the trade credit offer will be. Thus, we expect days of sales outstanding to be positively related to demand elasticity and negatively related to variable cost and bad debts provision.

Using these two hypotheses we can test our model, suggesting that trade credit can be explained by an agency model considering a trade-off between adverse selection costs and moral hazard consequences. We can express this model as follow:

$$DSO_i = \beta_0 + \beta_1 DEL_i + \beta_2 VCO_i + \beta_3 BDE_i + \beta_4 SEC_i + \beta_5 PER_i + \beta_6 SIZE_i + \beta_7 FIX_i + \beta_8 EBIT_i + \beta_9 DPA_i + \varepsilon_i \quad (2)$$

where all the variables are displayed in Table 1.

[INSERT TABLE 1 ABOUT HERE]

4. DATA AND METHODOLOGY

Our sample was first composed of 348 active manufacturing companies in the UK (SIC 2000 through 3999) from the Compustat Global Vantage database for the three-year period ending in 2002. We decided to restrict our sample to manufacturing firms because it is in this category where trade credit is produced in its habitual form. To reduce the variability all variables are averaged over the three-year period. We excluded from our sample 9 outlying observations and another 45 were lost because of missing values. This reduced our sample to 294 observations. The firms in our sample are industry dispersed, i.e., the sample does not appear to be more concentrated in any industry. Producers of perishables only represent 9% of our sample and high quality producers represent 44%. Table 2 shows the distribution between industries for our original sample.

[INSERT TABLE 2 ABOUT HERE]

Descriptive data for the variables used in our analysis and Pearson´s Correlation are in Table 3 and 4, respectively. We can see that firms in our sample are relatively large, with average total assets of over £1.9 million. The days of sales outstanding (DSO) is around 76 days and the median is 72.42 days.

Our analyses show that firms in our sample have on average more than 20% of their assets represented by accounts receivable. Some of them have more than 50% of their total assets represented by accounts receivable.

[INSERT TABLE 3 ABOUT HERE]

[INSERT TABLE 4 ABOUT HERE]

5. RESULTS

To contrast the two hypotheses related to our proposed agency model and find some evidence on trade credit theory, we will first develop a univariate test to compare results with those Long, Malitz and Ravid (1993) found for USA companies and also check the behavior of our new variables included in the model and then we will try to find more conclusive evidence using a multivariate method. In order to test traditional models we also included other variables.

5.1. Univariate test

We use a cross-sectional t-test of differences between firms with days of sales outstanding below the median (72.42 days) and those above the median.

We also use the Levene test[4] to contrast the equality of the variances. Except for SIZE, EBIT, DPA and DEL variables, the t-test shows that, for the agency model proposed, all differences are significant at the 5% level or less (see Table 5). Although the BDE variable shows significant differences between those two groups, results were the opposite to what was expected. That is, firms from the group High DSO showed greater values. Consequently, evidence is mixed to support hypotheses 1 and 2.

[INSERT TABLE 5 ABOUT HERE]

Companies offering trade credit above the median of our sample show higher levels of FIX; this supports the asymmetric information proposition that the consequences of adverse selection are mitigated by the existence of fixed assets. Thus, buyers will be less affected by adverse selection costs.

Our analyses are consistent with the findings of Long, Malitz and Ravid (1993). The outcomes of the two dummy variables included in t-test contrast are as expected. As a result, High-Tech producers usually extend more credit for buyers to allow them to check the real quality of the goods before payment and producers of perishable and easy-to-observe goods do not.

Differences between the two groups are not significant for the variable EBIT, thus we do not confirm the proposed idea which suggests that the greater the earnings of the provider, the smaller the cost of adverse selection to the buyer. For the same reason, we do not confirm the supposition that large firms, which probably have a good reputation, extend less credit than smaller firms that probably have not yet built up their reputation.

Finally, as we have projected, the variable costs present differences between the two groups. The VCO, one of our measurements of the moral hazard phenomenon, on average, is statistically different between companies that extend large credit terms and those that only extend short terms of credit. The High DSO group has smaller levels of VCO indicating that the bigger the variable cost, the greater the consequences of moral hazard and the shorter the credit terms will be.

TD and CVS, variables included in the test in order to contrast traditional models, were not significant.

According to univariate t-test results, evidence partially confirms product quality theory of trade credit but does not support liquidity and tax theory. Neither do we have enough evidence to make any inference about cost transaction theory. Results are also inconclusive about the relevance of the moral hazard influence in trade credit decision.

[4] We assume equal variances for those variables with a significance value above 0.05.

5.2. Results of multivariate test

To confirm our findings with a greater level of reliance or even to find more evidence to support the proposed agency theory and then confirm the relevance of moral hazard, we use multiple regression through the ordinary least square method. Table 6 shows regression results.

[INSERT TABLE 6 ABOUT HERE]

Our regression results present an adjusted R^2 of 0.356. The picture that emerges from Table 6 is quite similar to the one from the univariate test, although there are some differences. The principal difference is that by using the multivariate test SIZE, EBIT, DPA and the DEL variables are now significant. Those differences give more support to our proposed agency model.

The negative and significant relation between SIZE and DSO supports the asymmetric information theory based on product quality guarantee argument and is not consistent with liquidity theory which proposes that firms of known liquidity, with large access to the financial market, should extend trade credit to those more constrained. Instead, we find that smaller companies, with their reputation not yet constructed, extend larger trade credit to allow clients to check product quality and then build their status as high quality firms.

Once more supporting the asymmetric information theory, the variable FIX shows a positive relation with DSO. According to the construction of the variable, the greater its value, the smaller the proportion of fixed assets for a company. Thus, trade relations between buyers and providers with a high proportion of fixed assets present smaller problems of adverse selection.

The results for the SIC dummy variable are also as expected. Firms categorized as high quality producers extend more credit than those categorized as low quality producers. Therefore, companies whose products are considered high quality offer a period of credit great enough to permit their clients to check the real quality of goods before payment.

The PER dummy variable, as predicted, is negatively related to DSO. Again, results are consistent with product quality theory. Therefore, firms whose products are classified as easy-to-observe quality (perishable goods) offer shorter terms of credit than others.

Contrary to the results for the univariate test, the EBIT variable is now significant showing the expected relation with DSO. The more firms earn the shorter is the credit offered. These results confirm our evidence supporting the product quality argument that the greater the seller's earnings, the weaker the consequences of adverse selection to buyers.

Analyzing the same EBIT coefficient we do not find support to accept liquidity and tax theory. According to liquidity theory, firms presenting a comfortable financial situation offer credit to those presenting an opposite

situation. We understand that highly profitable companies have a good financial situation and our results show evidence supporting a negative, not a positive relation, between EBIT and DSO. To reject the tax hypothesis we must interpret Brick and Fung's (1984) proposition that companies in higher tax brackets offer credit to those in lower tax brackets. Otherwise, buyers could borrow with a lower after-tax cost than sellers and then, buy cash. This argument works only in the case of the existence of seller earnings, because this ensures a smaller after-tax cost for the debt. As our results show that the greater the EBIT the shorter the DSO variable, we have evidence to reject the tax proposition.

Although EBIT and SIZE results are not consistent with liquidity theory, outcome for the DPA variable is consistent with liquidity theory, because it predicts that credit offer is inverse-related to credit used. If the main argument of the liquidity theory is that companies offer trade credit because they have wide access to the financial market and at a lower cost, they should not need to use trade credit. Therefore, trade credit extended and trade credit used are mutually exclusive.

According to our findings, the greater the demand elasticity, the smaller the consequences of the moral hazard borne by the provider and the less risky will be the trade credit offered by a firm. Thus, firms with a high level of demand elasticity will extend more trade credit.

Regression results are in accordance with the arguments presented in Section 3, which predict that the variable costs negatively influence the length of the trade credit. Thus, sellers with a high level of variable costs will be more strongly affected in case of buyer default than those with lower levels and consequently will extend less credit.

The unexpected results for the BDE variable may be related to the poor liquidity situation of risk clients. According to our previous argument, firms whose clients are considered "high risk", i.e. presenting high levels of BDE, should raise cash discounts offered to attract risk clients to pay soon and thus avoid bad debts. Unfortunately, these risk clients, probably because of their insolvency situation, can not make use of discounts offered and then pay the total value on the net date. To solve this problem we run another regression to check if there is a determinate level of bad debts that make trade credit offered show a different sign.

To run this regression we constructed a dummy variable that takes the value of 1 if a company is placed above the 66.66 percentile for the BDE variable and zero otherwise. The new model is expressed as follow:

$$DSO_i = \beta_0 + \beta_1 DEL_i + \beta_2 VCO_i + \beta_3 BDE_i + \beta_4 BDE2_i + \varepsilon_t \qquad (3)$$

where BDE2 is the BDE variable multiplied by the dummy variable constructed. Results are reported in Table 7.

[INSERT TABLE 7 ABOUT HERE]

Our results can now confirm hypothesis 2 that BDE and DSO are inversely related. We even find evidence to support our previous supposition that when clients present a very high level of risk, seller's efforts to diminish the average collection period are never enough and in this case a positive relation between trade credit and bad debts arises. For the other variables representing the moral hazard, coefficients keep their expected sign and significance.

Overall, our results totally confirm the product quality guarantee argument and consequently the positive influence of the adverse selection phenomenon on trade credit offered and also confirm the moral hazard argument. Therefore, we confirm hypothesis 1, except for the DPA variable, and even confirm hypothesis 2. We also find evidence to reject tax theory and mixed results for the liquidity theory.

5.3. Testing traditional models

To strengthen our findings regarding traditional theories and also to compare our findings using the agency model proposed, we run five more regressions.

To test the tax theory, which predicts that sellers offer trade credit because they have access to funds at a lower after-tax cost than buyers, we use TD, a measurement for total debt. If sellers have a high level of debt, they are less likely to obtain another loan with tax deductible interest and thus reduce its borrowing cost. TD is the sum of long term debt and debt in current liabilities as a percentage of total asset averaged over the three year period. We expect TD to be negatively related to DSO. We also use EBIT as an independent variable since if a seller does not show earnings its tax will not be deductible. Equation 4 shows the tax model and the results are reported in Table 8.

$$DSO_i = \beta_0 + \beta_1 EBIT_i + \beta_2 TD_i + \varepsilon_i \qquad (4)$$

[INSERT TABLE 8 ABOUT HERE]

Although this model only shows an adjusted R^2 of 0.014 and the result for the EBIT variable is not significant, its outcome shows that the coefficient for the TD variable is significant at 5% level, thus supporting the argument that companies showing high levels of debt tend to offer less credit. As a consequence, this result supports the tax theory.

Liquidity theory is tested using a model composed of three explicative variables: SIZE, EBIT and DPA. Equation 5 shows this model.

$$DSO_i = \beta_0 + \beta_1 SIZE_i + \beta_2 EBIT_i + \beta_3 DPA_i + \varepsilon_i \qquad (5)$$

As this theory suggest that firms with wider access to the financial market and showing more liquidity tend to extend credit to those with restricted access to the financial market and also predicts that firms will either purchase on credit or sell on credit, but not both, DSO is expected to be directly related to SIZE and EBIT and inversely related to DPA. Results are reported in Table 9.

[INSERT TABLE 9 ABOUT HERE]

Results for this test offer mixed support for the liquidity theory. As the result shows, on the one hand, the coefficient for EBIT is not significant and for SIZE it shows a negative sign, which does not support the liquidity theory but gives support to the product quality argument of the asymmetric information theory. On the other hand, the coefficient for the DPA variable is negative as predicted by the theory. Therefore firms tend to offer trade credit or buy on credit but not both and large firms tend to extend less credit than small firms.

To test the operational argument of transactional cost theory we regress the DSO using as an explanatory variable the CVS (coefficient of variation of sales). This theory predicts that trade credit is important only when demand variability exists. CVS is calculated as the standard deviation of total revenue over the four year period ending in 2002. We expect DSO to be positively related to CVS. The transaction cost model is shown in equation 6 and the results are given in Table 10.

$$DSO_i = \beta_0 + \beta_1 CVS_i + \varepsilon_i \quad (6)$$

[INSERT TABLE 10 ABOUT HERE]

The regression result for this model shows that CVS is negatively related to DSO. This relation does not support the operational argument of the cost transaction theory that trade credit is important only when demand fluctuates.

To test the asymmetric information theory based on the argument that as clients do not know ex-ante goods quality and thus trade credit must be offered to allow them to check product quality before payment, we regress DSO using all those variables used in the agency model to proxy the adverse selection phenomenon without including those variables used to proxy the moral hazard. Equation 7 shows the regression model and Table 11 reports our results.

$$DSO_i = \beta_0 + \beta_1 SEC_i + \beta_2 PER_i + \beta_3 SIZE_i + \beta_4 FIX_i + \beta_5 EBIT_i + \beta_6 DPA_i + \varepsilon_i \quad (7)$$

[INSERT TABLE 11 ABOUT HERE]

Except for SIZE and DPA, the results for all the variables included in the model support the product quality guarantee argument. Thereby, firms from very specific industries that produce high quality goods tend to offer more credit than those from industries of perishable goods. Also, small firms and those presenting a small proportion of fixed assets in their balance sheets tend to offer more credit than larger firms with high proportion of fixed assets. Results for these variables are very similar to those already found in our agency model.

As these test shows, although some of these models were supported while others were not or have presented only mixed support, their explanatory power was not as strong as the agency model proposed. While the agency model presents an adjusted R^2 of 0.356, the traditional model with the higher adjusted R^2 was the one testing the asymmetric information theory with the value of 0.224. Thereby we run one last regression including all the variables used in these traditional models to compare results against the agency model. Equation 8 shows the regression model and Table 12 reports the result.

$$DSO_i = \beta_0 + \beta_1 SEC_i + \beta_2 PER_i + \beta_3 SIZE_i + \beta_4 FIX_i + \beta_5 EBIT_i + \beta_6 DPA_i + \beta_7 CVS_i + \beta_8 TD_i + \varepsilon_i \quad (8)$$

[INSERT TABLE 12 ABOUT HERE]

Especially in three points, the results reported in Table 12 lead us to the same conclusions we already have. First, the agency model can explain more than other traditional models, since again the adjusted R^2 is not as great as that presented in Table 6. Second, evidence again supports the asymmetric information theory. Third, again the liquidity theory only has weak support.

The main difference between this test and those testing each theory separately changes the conclusion about tax theory. If when we tested the tax theory, the TD variable was negatively related to DSO as expected, in this regression it is not significant even at a level of 10%. Therefore, these new results do not support the tax argument.

6. CONCLUSIONS

This paper proposes an agency model to explain trade credit offered. Based on the agency problem suggested by Jensen and Meckling (1976), we consider that in a relation between a seller and a buyer two phenomena are observable: adverse selection and moral hazard. The former exists when, because of asymmetric information, buyers do not know ex-ante characteristics or quality of the product being acquired. The latter is the possibility of the contractual relationship not being carried out and the worst consequence is the appearance of bad debts. This paper also checks some traditional theories such as liquidity, tax and transaction cost. To contrast these models a sample of UK manufacturing companies is used.

According to the results, traditional models such as liquidity, tax and transaction cost do not offer a complete explanation for the trade credit extended. We did not find evidence to support tax and transaction cost theories. For the liquidity theory, results were only mixed. The product quality argument is valid but not sufficient and the moral hazard phenomenon is useful to complement the model. Therefore, our agency model based on a trade off between adverse selection and moral hazard offers a better explanation since it considers aspects related to trade credit risk such as the variable cost assumed by the provider, the demand elasticity and bad debts.

Our model suggests and finds evidence that high quality, smaller and less profitable firms, which have less fixed assets, are more likely to extend credit because their relationship with clients presents more adverse selection problems. We also find that firms with high levels of variable cost and low levels of demand elasticity extend less credit because they support higher levels of moral hazard consequences.

We also found evidence that the greater the bad debts for a company the shorter the average collection period will be. This occurs because sellers tend to offer more attractive discounts for cash payments or will reduce credit terms when clients' risk increases. Furthermore, we also found evidence that when bad debts are very high, sellers' efforts to diminish the average collection period and trade risk are never sufficient, since their clients probably do not present sufficient liquidity to take advantage of cash discounts or to pay up to date.

Concluding, as adverse selection is already a recognized phenomenon related to trade credit, moral hazard has just started to be such. Thus, further research can be carried out to reinforce this model. Better proxies for moral hazard can be established for the future and research from the buyer's point of view should be done in order to contrast these ideas, since buyers' risk is easy to measure using traditional models.

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APPENDIX

Table 1: Expected Sign

Phenomenon	Variables	Expected Sign
Adverse Selection	SEC	+
Adverse Selection	PER	-
Adverse Selection	SIZE	-
Adverse Selection	FIX	+
Adverse Selection	EBIT	-
Adverse Selection	DPA	+
Moral Hazard	DEL	+
Moral Hazard	VCO	-
Moral Hazard	BDE	-

Table 2: Industry Distribution

Sic	INDUSTRY	Nº.	%
20	Food and Kindred Products	29	8%
21	Tobacco Products	3	1%
22	Textile Mill Products	11	3%
23	Apparel and Other Finished Products Made from Fabrics and Similar Materials	13	4%
25	Furniture and Fixtures	7	2%
26	Paper and Allied Products	11	3%
27	Printing, Publishing, and Allied Industries	27	8%
28	Chemicals and Allied Products	45	13%
29	Petroleum Refining and Related Industries	3	1%
30	Rubber and Miscellaneous Plastic Products	12	3%
31	Leather and Leather Products	3	1%
32	Stone, Clay, Glass, and Concrete Products	21	6%
33	Primary Metal Industries	11	3%
34	Manufactured Metal Products, Except Machinery and Transport Equipment	10	3%
35	Industrial and Commercial Machinery and Computer Equipment	30	9%
36	Electronic and Other Electrical Equipment and Components, Except Computer Equipment	50	14%
37	Transport Equipment	19	6%
38	Measuring, Analyzing, and Controlling Instruments; Photographic, Medical and Optical Goods; Watches and Clocks	32	9%
39	Miscellaneous Manufacturing Industries	11	3%
Total	-	348	100%

Table 3: Descriptive Statistics

	DSO	SIZE	EBIT	FIX	VCO	DEL	BDE	SEC	PER	DPA	TD	CVS	ACCTS
N	294	294	294	294	294	294	294	294	294	294	294	294	294
Average	76,76	1804,91	155,84	,39	,72	-,06	,02	,46	,08	431,03	,23	,27	,21
Stand. Dev..	35,40	9598,38	1116,92	,85	1,07	,53	,02	,50	,27	2789,03	,29	1,32	,10
Minimum	8,17	,19	-3030,25	-13,01	,00	-4,80	,00	,00	,00	,12	,00	,01	,01
Median	72,42	113,55	4,80	,47	,62	-,01	,00	,00	,00	62,79	,19	,14	,20
Maximum	295,14	148073,67	15439,00	1,00	16,68	4,33	,14	1,00	1,00	42267,83	4,21	22,54	,53

Notes:
DSO stands for the days of sales outstanding averaged over the three-year period.
SIZE represents the three-year period average of firms total assets .
EBIT represents the three-year period average of firms EBIT.
FIX is the fixed assets proportion on firms total assets averaged for the three-year period.
VCO represents the three-year period average for cost of goods sold divided by total assets.
DEL stands for the three-year period average for the differences between sales as a proportion of total assets in year x and sales as a proportion of total assets in year x-1, divided by the differences between average collection period in year x and average collection period in year x-1.
BDE is the three-year period average of the data provision-other divided by total assets.
SEC is a dummy variable which takes the value of 1 if goods sold need a significant time to verify their quality and zero otherwise.
PER stands for a dummy variable which takes the value of 1 if goods sold are perishable or easy to observe quality and zero otherwise.
DPA represents the days to pay accounts payable averaged over the three-year period.
TD represents the sum of long term debt and debt in current liabilities as percentage of total asset averaged over the three year period.
CVS is the standard deviation of total revenue over the four year period ending in 2002.
ACCTS stands for the accounts receivable as a proportion of total asset averaged over the three year period.

Table 4: Pearson´s Correlation

		LNDSO	DEL	VCO	BDE	SEC	PER	SIZE	FIX	EBIT	DPA
LNDSO	Pearson´s Correlation	1	,190	-,236	,126	,276	-,367	-,153	,181	,028	-,134
	Sig. (2-tailed)	,	,001	,000	,031	,000	,000	,008	,002	,636	,022
DEL	Pearson´s Correlation	,190	1	-,300	,016	,144	,030	,090	,233	,242	,012
	Sig. (2-tailed)	,001	,	,000	,787	,013	,607	,122	,000	,000	,842
VCO	Pearson´s Correlation	-,236	-,300	1	-,026	-,072	-,038	-,262	-,833	-,837	-,092
	Sig. (2-tailed)	,000	,000	,	,663	,221	,516	,000	,000	,000	,117
BDE	Pearson´s Correlation	,126	,016	-,026	1	,149	-,129	,327	,056	,022	,037
	Sig. (2-tailed)	,031	,787	,663	,	,010	,027	,000	,335	,713	,529
SEC	Pearson´s Correlation	,276	,144	-,072	,149	1	-,267	-,121	,146	,041	,017
	Sig. (2-tailed)	,000	,013	,221	,010	,	,000	,037	,013	,481	,776
PER	Pearson´s Correlation	-,367	,030	-,038	-,129	-,267	1	,186	-,047	,047	,112
	Sig. (2-tailed)	,000	,607	,516	,027	,000	,	,001	,426	,423	,054
SIZE	Pearson´s Correlation	-,153	,090	-,262	,327	-,121	,186	1	,201	,265	,127
	Sig. (2-tailed)	,008	,122	,000	,000	,037	,001	,	,001	,000	,029
FIX	Pearson´s Correlation	,181	,233	-,833	,056	,146	-,047	,201	1	,880	-,012
	Sig. (2-tailed)	,002	,000	,000	,335	,013	,426	,001	,	,000	,835
EBIT	Pearson´s Correlation	,028	,242	-,837	,022	,041	,047	,265	,880	1	,015
	Sig. (2-tailed)	,636	,000	,000	,713	,481	,423	,000	,000	,	,797
DPA	Pearson´s Correlation	-,134	,012	-,092	,037	,017	,112	,127	-,012	,015	1
	Sig. (2-tailed)	,022	,842	,117	,529	,776	,054	,029	,835	,797	,

Notes:
** Significant at the 0.01 level (bilateral).
* Significant at the 0.05 level (bilateral).

Table 5: Test of independent samples

Variables	Low DSO	High DSO	T-Statistic of Difference
SIZE	5,2668	4,9155	-1,524
FIX	,2907	,4960	2,075**
EBIT	-,0745	-,0700	,036
SEC	,36	,55	3,218***
PER	,14	,01	-4,251***
VCO	,9136	,5375	-3,049***
DEL	-,0966	-,0308	1,059
BDE	,0116	,0191	2,707***
DPA	636,9437	227,8906	-1,251
TD	,2385	,2142	-,719
CVS	,3349	,2085	-,821

Notes:
** Significant at the 0.05 level.
*** Significant at the 0.01 level.
[a] Low DSO is defined as DSO less than the median of 72.42 days.
[b] High DSO is defined as DSO greater than the median of 72.42 days.

Table 6: Multivariate Tests of the Agency Model

Independent Variables	Coefficient	T-Statistic	
Constant		4,527	52,533***
DEL		0.103	2.362**
VCO		-0.283	-6.747***
BDE		2.241	2.241**
SEC		0.101	2.101**
PER		-0.464	-5.280***
SIZE		-3.623E-02	-2.827***
FIX		0.107	1.757*
EBIT		-0.289	-6.033***
DPA		-2.318E-05	-2.868***
Adjusted R square:	0.356		
F-Statistic:	19.024		

Notes:
* Significant at the 0.10 level
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

Table 7: Multivariate Tests of the Moral Hazard

Independent Variables	Coefficient	T-Statistic	
Constant		4.293	109.388***
VCO		-8.539E-02	-3.327***
DEL		0.112	2.172**
BDE		-14.212	-1.703*
BDE2		16.188	1.996**
Adjusted R square:	0.085		
F-Statistic:	7.829		

Notes:
* Significant at the 0.10 level
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

Table 8: Multivariate Tests of the Tax Theory

Independent Variables	Coefficient	T-Statistic	
Constant		4.304	104.048***
TD		-0.356	-2.408**
EBIT		-6.210E-02	-1.561
Adjusted R square:	0.014		
F-Statistic:	3.014		

Notes:
* Significant at the 0.10 level
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

Table 9: Multivariate Tests of the Liquidity Theory

Independent Variables	Coefficient	T-Statistic	
Constant		4.428	57.414***
SIZE		-3.724E-02	-2.625***
EBIT		3.096E-02	1.196
DPA		-1.921E-05	-1.979**
Adjusted R square:	0.032		
F-Statistic:	4.188		

Notes:
* Significant at the 0.10 level
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

Table 10: Multivariate Tests of the Transaction Costs Theory

Independent Variables	Coefficient	T-Statistic	
Constant		4.238	152.972***
CVS		-3.779E-02	-1.835*
Adjusted R square:	0.008		
F-Statistic:	3.368		

Notes:
* Significant at the 0.10 level
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

Table 11: Multivariate Tests of the Asymmetric Information Theory

Independent Variables	Coefficient	T-Statistic	
Constant		4.178	52.221***
SEC		0.132	2.570**
PER		-0.459	-4.821***
SIZE		-1.760E-02	-1.359
FIX		0.276	4.484***
EBIT		-0.169	-3.447***
DPA		-1.421E-05	-1.623
Adjusted R square:	0.224		
F-Statistic:	15.059		

Notes:
* Significant at the 0.10 level
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

Table 12: Multivariate Tests of the Asymmetric Information, Transaction Costs, Liquidity and Tax Theories.

Independent Variables	Coefficient	T-Statistic	
Constant		4.276	52.597***
SEC		0.149	2.994***
PER		-0.446	-4.798***
SIZE		-2.538E-02	-1.929*
FIX		0.184	2.885***
EBIT		-0.505	-5.671***
DPA		-1.515E-05	-1.790*
CVS		-0.376	-4.725***
TD		0.209	1.455
Adjusted R square:	0.275		
F-Statistic:	14.889		

Notes:
* Significant at the 0.10 level
** Significant at the 0.05 level.
*** Significant at the 0.01 level.