HOW DOES WORKING CAPITAL MANAGEMENT AFFECT SPANISH SMES PROFITABILITY?

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Abstract

This paper analyzes the relation between working capital management and profitability for small and medium-sized firms by controlling for unobservable heterogeneity and possible endogeneity. Unlike previous studies, we examine a non-linear relation between these two variables. Our results show that there is a non monotonic (concave) relationship between working capital level and firm profitability, which indicates that SMEs have an optimal working capital level that maximizes their profitability. In addition, a robustness check of our results confirms that firms' profitability decreases as they move away from their optimal level.

K**eywords:** Cash Conversion Cycle; working capital; profitability; SMEs.

JEL classification: G30, G31, G32.

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Abstract

This paper analyzes the relation between working capital management and profitability for small and medium-sized firms by controlling for unobservable heterogeneity and possible endogeneity. Unlike previous studies, we examine a non-linear relation between these two variables. Our results show that there is a non monotonic (concave) relationship between working capital level and firm profitability, which indicates that SMEs have an optimal working capital level that maximizes their profitability. In addition, a robustness check of our results confirms that firms' profitability decreases as they move away from their optimal level.

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1. Introduction

The idea that working capital management affects a firm's profitability and risk is generally accepted and has recently received considerable attention. Smith (1980), for instance, suggests that working capital management is important because of its effects on a firm's profitability and risk, and consequently on its value. Specifically, a more aggressive working capital policy (low investment in working capital) is associated with

a higher return and higher risk, while a conservative working capital policy (high investment in working capital) supposes lower return and risk.

Studies on working capital management and firm performance (Jose, Lancaster and Stevens 1996; Shin and Soenen 1998; Wang 2002; Deloof 2003; and Garcia-Teruel and Martinez-Solano 2007; among others) have analyzed a linear relationship between a firm's investment in working capital and its profitability. Their findings indicate that the lower the investment in working capital the higher the profitability. However, they ignore, for instance, the higher risk of loss of sales and interruptions in the production process that is related with low levels of working capital. There might, therefore, be a working capital level at which a reduction in working capital negatively affects a firm's profitability.

The relation between working capital and a firm's profitability may, consequently, be concave rather than linear, and might be better captured by a quadratic relationship. Unlike previous studies, this paper contributes to the literature by analyzing the relationship between investment in working capital and profitability by taking into account the possible non-linearities of the working capital management-profitability relation in order to test this risk and return trade-off between different working capital strategies. In addition, to verify the robustness of our results, we employ a different approach. We follow Tong (2008) in testing this possible quadratic relation. The estimation method applied in this study was selected in order to avoid unobservable heterogeneity and possible endogeneity, because if we do not control for these problems, estimation results might be seriously affected. Specifically, panel data and the Generalized Method of Moments (GMM) are used to estimate our models.

We use a sample of small and medium sized Spanish firms for several reasons. Firstly, most previous studies have basically focused on large firms (Jose, Lancaster and Stevens 1996; Shin and Soenen 1998; Wang 2002; Deloof 2003). Secondly, SMEs are subject to important financial constraints (Whited 1992; Fazzari and Petersen 1993; and Audretsch and Elston 1997) and have difficulties in obtaining funding in the long-term capital markets (Walker 1989; Petersen and Rajan 1997; and Scholtens 1999), which means that an efficient working capital management is particularly important (Peel and Wilson 1996; Peel, Wilson and Howorth 2000). In this line, Grablowsky (1984) and Kargar and Blumenthal (1994) suggest that working capital management may be crucial for the survival and growth of small companies. Thirdly, the interest in studying Spanish firms stems from the fact that they operate in a banking-oriented financial system, where capital markets are less developed (Schmidt and Tyrell 1997). Our results may, therefore, also be of interest for other SMEs established in countries with similar financial systems, as indeed occurs in most European countries. Spanish firms have few alternatives for obtaining external financing, which makes them more dependent on trade credit. Demirguc-Kunt and Maksimovic (2002) suggest that such firms grant more trade credit to their customers and at the same time receive more finance from their own suppliers. Indeed, according to the *European Payment Index Report* (2007)[1], the average term of payment for Spain is 67.40 days - one of the longest effective payment periods in European countries (Marotta 2001). Moreover, investment in inventories tends to be quite persistent in Spain (Benito 2005). He demonstrates that, in spite of their great bank dependence, Spanish firms have less sensitivity of inventories to liquidity than companies from the United Kingdom.

[1] European Payment Index is a report based on an annual written survey carried out by *Intrum Justia* in 25 European countries and involves several thousand companies.

The results confirm our hypothesis that there is an inverted U-shaped relationship between working capital and profitability, which indicates that both high and low working capital levels are associated with a lower profitability. The relation between working capital and profitability is positive when firms hold low levels of working capital and becomes negative for higher levels of working capital. This allows us to confirm not only the greater profitability effect but also the greater risk effect for firms with low levels of working capital.

The remainder of this paper is organized as follows. Section 2 outlines the theoretical links between working capital policy and profitability. Section 3 describes the model employed to analyze the relationship between working capital and a firm's performance and the hypotheses to be tested. In Section 4, we describe the methodology and data used. The results are discussed in Section 5 and a robustness check is presented. Section 6 concludes the paper.

2. Working capital policy and profitability.

Lewellen, McConnel, and Scott (1980) showed that, under perfect financial markets, trade credit decisions do not influence firm value. However, capital markets are not perfect and the literature has demonstrated the existence of optimal levels of all individual components of working capital, such as accounts receivable (Emery 1984a; Nadiri 1969), inventories (Ouyang, Teng, Chuang, and Chuang 2005) and accounts payable (Nadiri 1969). Based on this idea, and taking into account the influence of working capital on both risk and profitability, we hypothesize that the relationship between working capital and firm profitability might be concave rather than linear.

As noted in the Introduction, the way in which a firm manages its working capital can have a significant impact on both the risk (risk of loss of business and interruptions of production process) and profitability. Specifically, working capital management practices that tend to enhance profitability tend to increase this risk and, conversely, practices that reduce the risk tend to decrease the performance expected.

Since an additional investment in inventories or accounts receivable is usually associated with greater sales, a positive relation between working capital and profitability might be expected. Larger inventories can prevent interruptions in the production process and loss of business due to scarcity of products and can also reduce supply costs and price fluctuations (Blinder and Maccini 1991). In addition, they allow firms to provide their customers with a better service and avoid high production costs arising from large fluctuations in production (Schiff and Lieber 1974). Granting trade credit also stimulates sales because it allows buyers to verify product and services quality prior to payment (Smith 1987; Long, Malitz and Ravid 1993; and Lee and Stowe 1993) and, hence, it reduces the asymmetric information between buyer and seller. In addition, trade credit is an important supplier selection criterion when it is difficult to differentiate products (Shipley and Davis 1991; and Deloof and Jegers 1996); it is used as an effective price cut (Brennan, Maksimovic, and Zechner 1988; Petersen and Rajan 1997); it encourages customers to acquire merchandise at times of low demand (Emery 1987); it reduces transaction costs (Ferris 1981; and Emery 1987) and strengthens long-term supplier-customer relationships (Ng, Smith, and Smith 1999; Wilner 2000), to name but some of the advantages. Thus, a high investment in working capital can increase a firm's performance.

However, this additional investment in working capital may also adversely affect operating performance if the costs of a higher investment in working capital exceed the

benefits of holding more inventories and/or of granting more trade credit to customers. Firstly, a firm might not assess the quality of the products bought before paying if it reduces its received trade credit period (Deloof 2003), which might negatively affect profitability. Secondly, Soenen (1993) suggests that high investments in working capital might also lead companies to bankruptcy, so their suppliers could cut off the supply of the regularly purchased merchandise (Cuñat 2007) or, in the case of non-payment, this could be recovered and sold to another customer. Thirdly, and from the point of view of inventories, keeping stock available also supposes costs such as warehouse rent, insurance and security expenses, which tend to rise as the level of inventory increases (Kim and Chung 1990). Finally, the finance literature has demonstrated that an increase of investment in current assets would increase total assets without a proportional increase in profitability.

As a result of the costs and benefits of a higher investment in working capital, there may be an inverted U-shaped relationship between a firm's profitability and investment in working capital and, hence, firms might have an optimal working capital level that balances costs and benefits and maximizes their profitability. Specifically, we expect firms' profitability to rise as working capital increases until a certain working capital level is reached, given that the increased profitability will not offset the high risk borne. Conversely, beyond this optimum, due to the low return of current assets, we expect increases in working capital to be related with decreases in profitability. That is, we expect firm profitability and working capital to relate positively at low levels of working capital and negatively at higher levels.

The empirical evidence, however, is not consistent with the trade-off between profitability and risk hypothesis commented above (Jose, Lancaster and Stevens 1996; Shin and Soenen 1998; Wang 2002; Deloof 2003; and Garcia-Teruel and Martinez-

Solano 2007; among others). These studies have analyzed a linear relationship between working capital and profitability, and their results suggest that firms can increase their performance by reducing their working capital levels. However, those findings ignore the risk of loss of sales and interruptions in the production process related with low levels of working capital, which might also be captured with a non-linear relation.

3. Model and hypotheses

This section describes the model employed for testing the main hypothesis mentioned in the previous section, that is, that there exists a concave relationship between a firm's operating profitability and investment in working capital. This would allow us to confirm that firms have an optimal working capital level at which their profitability is maximized.

We use the Cash Conversion Cycle (CCC) as measure of working capital management as it has been the most used measure in studies, given the criticism of static measures such as current ratio and quick ratio (Emery 1984b; Soenen 1993). This variable is calculated as (accounts receivable/sales)*365 + (inventories/purchases)*365 - (accounts payable/purchases)*365. Thus, CCC deals with the management of accounts receivable, the management of inventories and the trade credit received, with a shorter CCC meaning a more aggressive working capital policy. Previous literature indicates the importance of considering these three components at the same time, because they influence each other and firms' profitability and value. Schiff and Lieber (1974), for instance, indicate the importance of taking into account the interrelationship between inventory and accounts receivable policies.

To validate our hypothesis, we regress the firm's operating profitability against cash conversion cycle and its square. The inclusion of these two variables allows us to test

both the profitability and risk effects commented above. Since previous studies find support for profitability persistence, a dynamic panel data model is used as in Goddard, Tavakoli, and Wilson (2005) and Feeny, Harris and Rogers (2005). In addition, following Deloof (2003) and Garcia-Teruel and Martinez-Solano (2007) among others, we control for firm size, growth of sales and leverage. Our profitability model is as follows:

$$PRO_{i,t} = \beta_0 + \beta_1 PRO_{i,t-1} + \beta_2 CCC_{i,t} + \beta_3 CCC^2{}_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t} \quad (1)$$

where $PRO_{i,t}$ is the profitability of firm i at time t; $CCC_{i,t}$ is the Cash Conversion Cycle of firm i at time t, and $CCC^2_{i,t}$ its square. $SIZE_{i,t}$ is the size of the firms, $GROWTH_{i,t}$ the growth of sales, and $LEV_{i,t}$ the leverage. The parameter λ_t is a time dummy variable, η_i is the unobservable heterogeneity or the firm's unobservable individual effects, and $\varepsilon_{i,t}$ is the random disturbance. Like Deloof (2003), we use two proxies to measure the profitability. PRO_1 is calculated by the gross operating income ((sales – cost of sales)/total assets); while PRO_2 represents the net operating income ((sales – cost of sales – depreciation & amortization)/total assets). We use these variables because they can reflect the operating activities of the firm better than the overall return on assets, and we relate them to the cash conversion cycle, which is another operating variable. The size (SIZE) is measured as the natural logarithm of sales; growth of sales (GROWTH) by the ratio $(sales_1\text{-}sales_0)/sales_0$; and leverage (LEV) as the ratio of debt to total assets. The parameter λ_t is a time dummy variable that changes in time but is equal for all firms in each of the time periods considered. This parameter is designed to capture the influence of economic factors that may also affect firms' profitability, but which companies cannot control. Finally, η_i is the firm´s unobservable heterogeneity and captures the particular characteristics of each firm.

The quadratic relation proposed in equation (1) presents a breakpoint, which can be derived by differentiating the firm profitability variable with respect to the CCC variable and making this derivative equal to 0. On solving for the CCC variable, we obtain that this breakpoint is $CCC_{i,t} = (-\beta_2 / 2\beta_3)$. To verify our main hypothesis, this should be a maximum, since this would indicate that there is an inverted U-shaped relationship between working capital and profitability and, hence, firms have an optimal working capital level at which they maximize their operating performance. Since this will be a maximum only if the second partial derivate of the profitability with respect to the Cash Conversion Cycle variable $(2\beta_3)$ is negative, β_3 should be negative.

4. Methodology and Data

Methodology

The estimation method was selected in order to avoid unobservable heterogeneity and the problem of possible endogeneity. Firms are heterogeneous and there are always characteristics that might influence their profitability that are difficult to measure or hard to obtain and which are not in our model. Hence, we use panel data to eliminate the risk of obtaining biased results (Hsiao 1985). We eliminate the individual effect by taking first differences. Moreover, we use the instrumental variable estimation method to avoid the problem of endogeneity, which might be present in our analysis. We use the two-step generalized method of moments (GMM) estimator proposed by Arellano and Bond (1991) because, although the estimator of instrumental variables in one stage is always consistent, if the disturbances show heteroskedasticity, the estimation in two stages increases efficiency. Finally, we should mention that we also control for industry effects by introducing eight industry dummies.

Data

This study utilises a data panel of non-financial Spanish SMEs. The data were obtained from SABI (Iberian Balance Sheets Analysis System) database, developed by Bureau Van Dijk. This database contains accounting and financial information for Spanish firms.

The sample comprises small and medium-sized firms from Spain for the period 2002-2007. The selection of SMEs was carried out according to the requirements established under European Commission recommendation 2003/361/EC of 6 May, 2003, i.e. they had fewer than 250 employees, turned over less than 50 million euros and possessed less than 43 million euros worth of total assets. Finally, we eliminated firms whose information was not available for at least five consecutive years[2], firms with lost values, cases with errors in the accounting data, and extreme values presented by all variables. We obtained an unbalanced panel of 1008 Spanish SMEs (5,862 firm-year observations).

Table 1 gives the mean values of Cash Conversion Cycle by sector and year. In addition, in the final column we present a t-statistic on the difference of means to determine if the mean length of CCC held by firms in 2002 differs significantly from that held in 2007. We conducted this test under the null hypothesis of equal means. Since t statistic takes the value 3.09, the null hypothesis is rejected and, hence, it indicates that Spanish SMEs have increased their investment in working capital during this period.

INSERT TABLE 1

Table 2 provides summary statistics of the variables used in the estimations. A more detailed description of the sample by size and sector is also given in Appendix 1. In Table

[2] This is a necessary condition to have a sufficient number of periods to be able to test for second-order serial correlation. A t-statistic on the difference of means indicates that this criterion for retaining data doesn't affect the mean values of the variables used in our study.

3 we present the correlations of the variables used in our model. As in Deloof (2003) and Garcia-Teruel and Martinez-Solano (2007), we find that cash conversion cycle and leverage are negatively correlated with profitability. These studies suggest that this is consistent with the view that the cash conversion cycle may be too long and that shortening it might increase profitability. The negative relation between leverage and profitability might be due to the fact that SMEs have higher borrowing costs because of their greater information asymmetries (Jordan, Lowe and Taylor 1998), greater informational opacity (Berger and Udell, 1998) and higher likelihood of bankruptcy, according to the trade-off theory. Moreover, according to Benito and Vlieghe (2000), highly leveraged firms could have more financing constraints and this may impede undertaking valuable investments and, hence, harm their profitability. This result is supported by Goddard et al. (2005). Finally, like in Goddard et al. (2005), a negative correlation between size and profitability is also obtained. This could be for several reasons. First, a greater diversification might lead to a lower profitability, as is demonstrated by previous studies. Second, managers tend to expand firm size to achieve their own pecuniary and non-pecuniary interests: managerial benefits associated with a larger dimension (Stulz, 1990), since they receive a higher remuneration in larger firms (Conyon and Murphy, 2000) and other possible private benefits, such as the prestige of managing larger firms (Dyck and Zingales, 2004).

INSERT TABLES 2 AND 3

We also used a formal test to ensure that the multicollinearity problem is not present in our analyses. We calculated the Variance Inflation Factor (VIF) for each independent variable included in our models. The largest VIF value is 1.48, so there is no multicollinarity problem in our sample, because the value is far below 5 (Studenmund, 1997).

5. Results

The results obtained from model (1) are presented in Table 4. The gross operating income (PRO_1) is used as dependent variable in column (1), while the net operating income (PRO_2) is used in column (2). Our findings indicate that β_3 is negative and significant in both equations, which confirms that firms have an optimal Cash Conversion Cycle that balances costs and benefits and maximizes operating performance[3]. In addition, it indicates, unlike previous studies, that profitability increases with the investment in working capital at low levels, and decreases at high levels. Thus, our results show the importance of also taking into account the risk of loss of business and interruptions in the production process in the working capital management-profitability relation using a non-linear relationship[4].

INSERT TABLE 4

Since the cash conversion cycle is calculated as (accounts receivable/sales)*365 + (inventories/purchases)*365 – (accounts payable/purchases)*365, it can take both positive and negative values. A positive CCC indicates that it is a use of funds and, hence, needs to be financed (Kieschnick, LaPlante and Moussawi 2009). However, as in Baños et al (2009), we obtain that the mean CCC is negative for sectors such as service and transport, which indicates that working capital is a source of funds in these industries (Fazzari and Petersen 1993). Once we had found a concave relationship between CCC and profitability, and given the substantial differences in CCC across industries observed

[3] The inclusion in the model of the cost of financing as independent variable does not alter these results.

[4] Like Deloof (2003), we find that Cash Conversion Cycle does not affect firms' profitability when we estimate a linear relationship.

in Table 1, we also re-estimated the quadratic model by taking sub-samples by industry in order to check whether this result holds for them. Specifically, we selected from our sample those sectors with a similar CCC. Thus, we re-estimated the quadratic relationship for the following four sub-samples: Agriculture and Mining sector, Construction sector, Wholesale and Retail trade sector, and Service and Transport sector. The results obtained, which are presented in Table 5, indicate that the concave relationship between cash conversion cycle and profitability is also maintained for all sub-samples, except for the Agriculture and Mining sector, where the coefficients are not significant. However, this non significant result might be due to the scarce number of firms in this sector. Similarly, although the results are not presented in this paper, it should be noted that we also obtain this concave relationship when we take subsamples by size and age[5].

INSERT TABLE 5

5.1. Robustness check

The model developed in section 3 is the most common empirical approach in testing the quadratic relation between two variables. The results obtained indicate that there is an inverted U-shaped relationship between investment in working capital and profitability, that is, firms have an optimal working capital level that maximizes their profitability and, hence, their profitability should decrease when they move away from this optimal level.

Our main goal here is to give robustness to the results obtained from the first model by studying the relation between deviations on both sides of optimal working capital level

[5] In particular, we divided our sample according to mean size and age. Then, we estimated the model for both firms above and below mean values. We also estimated the model for firms above percentile 90 in order to check whether we obtain similar results for larger and older firms. The results show that there is also a concave relationship for these sub-samples.

and firm profitability. If an optimum exists, both below-optimal and above-optimal deviations from this should reduce firm profitability. We use a two-stage methodology motivated by Tong´s (2008) study, which allows us to verify the existence of a concave relation between working capital and firm profitability. In the first stage we obtain deviations from optimal CCC, while in the second stage we regress firm profitability against those deviations. If our hypothesis is verified, that is deviations negatively affect profitability, this would allow us to give robustness to the results obtained in the first model.

Stage 1:

Following Baños-Caballero et al. (2009), we use equation (2) as the benchmark regression for the determinants of Cash Conversion Cycle length in SMEs:

$$CCC^{*}_{i,t} = \delta_0 + \delta_1 CFLOW_{i,t} + \delta_2 LEV_{i,t} + \delta_3 GROWTH_{i,t} + \delta_4 SIZE_{i,t} + \delta_5 AGE_{i,t} + \delta_6 FA_{i,t} + \delta_7 ROA_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $CCC^{*}_{i,t}$ represents the optimal Cash Conversion Cycle of firm i at time t; $CFLOW_{i,t}$ cash flow; $LEV_{i,t}$ the leverage; $GROWTH_{i,t}$ growth of sales; $SIZE_{i,t}$ the size; $AGE_{i,t}$ the age; $FA_{i,t}$ investment in fixed assets; $ROA_{i,t}$ return on assets; and $\varepsilon_{i,t}$ random disturbance. We calculate the CCC as (accounts receivables/sales)*365 + (inventories/purchases)*365 - (accounts payable/purchases)*365; CFLOW is the ratio of net profit plus depreciation to total assets; LEV the ratio of debt to total assets; GROWTH the ratio ($sales_1$-$sales_0$)/$sales_0$; SIZE the natural logarithm of assets; AGE the natural logarithm of age; FA the ratio *(Tangible fixed assets/total assets)*; and ROA the ratio Earnings Before Interest and Taxes over total assets.

Firms´ current Cash Conversion Cycle, however, may not always equal their desired cycle for several reasons. Nadiri (1969) suggests that firms cannot always estimate their sales

accurately and with certainty, and, hence, neither their purchases; they do not accurately anticipate changes in the opportunity cost of trade credit or in the rates of default and bad debts on their trade credit; the discovery and collection of delinquent accounts take time and involve costs which may be distributed over time; finally, disequilibrium in other assets of the firms, such as inventories, may also reflect this discrepancy. In this line, Sartoris and Hill (1983) indicate that when firms change their credit policy they can also have sources of uncertainty such as the fraction of sales paid with a discount, timing of payments, volume of sales, and the fractions of sales that are never paid by customers. Secondly, the difficulties firms have in order to access capital markets or their low bargaining power with customers and suppliers might lead firms to invest below or above their optimal working capital levels, respectively. Finally, the conflicts of interests between the main stakeholders (shareholders, managers and creditors) could also give rise to current working capital level not being equal to the desired level.

Based on this idea that firms' current CCC might not always equal their optimum, as in Tong (2008), we obtain the residuals from regression (2) and we use them as a proxy for the deviations from optimal Cash Conversion Cycle. Thus, once we have identified the deviations from the optimal cycle in Stage 1, then in Stage 2 we analyze how these deviations affect a firm's profitability.

Stage 2:

Following Tong (2008), since the residuals can be either positive or negative, we define the variable $Deviation_{i,t}$ as the absolute value of the residuals obtained from equation (2), so this measures the deviations from optimal CCC. Moreover, to test our hypothesis, we also define a dummy variable, $AOD_{i,t}$, which is equal to 1 for positive residuals and 0 otherwise. Thus, $AOD_{i,t}$ is equal to 1 if actual CCC is greater than optimal CCC, and is equal to 0 if otherwise. We then allowed this dummy to interact with the Deviation

variable. To test the effect of deviations from the optimum, we used the following profitability equations:

$$PRO_{i,t} = \alpha_0 + \alpha_1 PRO_{i,t-1} + \alpha_2 Deviation_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 GROWTH_{i,t} + \alpha_5 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t} \quad (3)$$

$$PRO_{i,t} = \gamma_0 + \gamma_1 PRO_{i,t-1} + \gamma_2 Deviation_{i,t} + \gamma_3 (Deviation * AOD)_{i,t} + \gamma_4 SIZE_{i,t} + \gamma_5 GROWTH_{i,t} + \gamma_6 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t} \quad (4)$$

All dependent and independent variables are the same as those specified in equation (1). We have eliminated only the CCC variable and its square, and we have inserted the Deviation variable and the interaction term. Therefore, in equation (3), the sign of α_2 indicates the effect of the deviations from optimum on firm performance, so we expect that $\alpha_2 < 0$, because this would indicate that the firm's profitability decreases when a firm moves away from its optimal CCC. In equation (4), γ_2 and $(\gamma_2 + \gamma_3)$ represent the influence of below-optimal deviations (i.e. when $AOD_{i,t}$ takes the value 0) and above-optimal deviations (i.e. when $AOD_{i,t}$ takes the value 1), respectively, on the firm's profitability. We expect that $\gamma_2 < 0$ and $(\gamma_2 + \gamma_3) < 0$, since this would indicate that both below-optimal and above-optimal deviations reduce the firm's profitability and, hence, that the firm's operating performance will increase until a certain working capital level is reached, after which the performance will start to decrease. Thus, firm managers should aim at keeping as close to the optimal cycle as possible and try to avoid any deviation (either positive or negative).

The results, which are presented in Table 6, are consistent with those obtained in the previous section. We find that a firm's profitability decreases when it moves away from its optimal CCC, since the coefficient of the Deviation variable (α_2) is negative and significant in equations (3a) and (3b). In equations (4a) and (4b), as we commented above,

γ_2 indicates the effect of below-optimal deviations on operating performance, while $(\gamma_2 + \gamma_3)$ represents the influence of above-optimal deviations on this performance. We obtain that γ_2 is negative and significant in both equations. With regard to the coefficient $(\gamma_2 + \gamma_3)$, we obtain that it is also negative and significant in both equation (4a) and equation (4b). Therefore, the results show, as we expected, that both below-optimal and above-optimal deviations reduce firms' profitability and firm managers should aim to keep as close to the optimal cycle as possible and try to avoid any deviation (either positive or negative) from it. In addition, the difference in the negative impacts on firm profitability is not statistically significant between above-optimal and below-optimal deviations, since the coefficient of the interaction term (γ_3) is not significant.

INSERT TABLE 6

6. Conclusions

This study offers new evidence on the relationship between working capital management and profitability by controlling for unobservable heterogeneity and possible endogeneity and, unlike previous studies, given the competing hypotheses of the effect of an increase in working capital on firm's profitability, it analyzes a possible quadratic relation between these variables.

In contrast to previous findings, which indicate that the lower the investment in working capital the more profitability, our results show that there is a concave relationship between working capital level and profitability, that is, firms have an optimal working capital level that balances costs and benefits and maximizes their profitability. It allows us to confirm not only the greater profitability effect, but also the greater risk effect for firms with low

levels of working capital. In addition, a robustness check demonstrates that firms' profitability decreases when they move away from their optimal working capital.

Overall, this paper highlights the importance of good working capital management for firms due to the cost of over-investment and under-investment in working capital. Our findings have potentially important implications for managers and in the literature on working capital management. On the one hand, they indicate that managers should aim to keep as close to the optimal cycle as possible and try to avoid any deviation (either positive or negative) in order to maximize firm´s profitability. On the other hand, we find that the relationship between working capital and profitability is concave rather than linear and, hence, a quadratic relationship should be used in subsequent studies.

As a limitation of our study, it should be noted that the mean size of the firms of our sample is higher than the mean size of the Spanish population of SMEs. This is due to the fact that in Spain smaller SMEs can elaborate an abridged financial statement, which presents less detailed information. Some information required for this study (for example the value of accounts payable) is not, therefore, available for such firms.

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Appendix 1

INSERT TABLE 7

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Table 1
Cash Conversion Cycle by year and sector

Industry	2002	2003	2004	2005	2006	2007	2002-2007	*t*
Agriculture and Mining	42.65	20.57	33.46	40.23	63.45	68.56	44.84	0.5060
Manufacturing	86.87	85.96	89.05	96.65	99.98	100.83	93.28	2.1586
Construction	38.11	37.41	35.05	40.85	47.53	65.31	44.01	2.0418
Wholesale trade	94.48	93.25	94.11	98.69	101.38	105.95	98.01	1.4721
Retail trade	64.54	58.65	66.08	72.10	71.77	78.95	68.70	1.4039
Services	-54.10	-35.64	-36.51	-34.44	-21.93	-43.70	-37.08	0.4009
Transport	-2.78	-20.51	-12.84	-9.94	-7.42	-1.29	-9.29	0.0777
Total	70.57	69.15	71.71	77.72	81.63	84.84	75.97	3.0915

This table shows the mean Cash Conversion Cycle by year and sector. The Cash Conversion Cycle is calculated as (accounts receivable/sales)*365 + (inventories/purchases)*365 - (accounts payable/purchases)*365.
t is the t-statistic in order to test whether the mean length of CCC held by firms in 2002 differs significantly from that held in 2007, under the null hypothesis of equal means.

Table 2
Summary statistics

	Mean	Standard deviation	Perc. 10	Median	Perc. 90
PRO_1	0.5020	0.2207	0.2493	0.4710	0.7957
PRO_2	0.4644	0.2119	0.2260	0.4315	0.7464
CCC	75.97	98.71	-25.12	69.86	197.79
SIZE	9.4252	0.5754	8.6883	9.4147	10.1968
GROWTH	0.0746	0.1665	-0.0938	0.0573	0.2589
LEV	0.6325	0.1839	0.3635	0.6536	0.8586

PRO_1 and PRO_2 denote the gross operating income and the net operating income, respectively. CCC is the Cash Conversion Cycle; SIZE is the size of the firm; GROWTH the growth of sales; and LEV the leverage.

Table 3
Correlation matrix

	PRO_1	PRO_2	CCC	SIZE	GROWTH	LEV
PRO_1	1.0000					
PRO_2	0.9916***	1.0000				
CCC	-0.2166***	-0.1976***	1.0000			
SIZE	-0.1984***	-0.1842***	0.0361***	1.0000		
GROWTH	0.0016	0.0082	-0.0649***	0.1828***	1.0000	
LEV	-0.2201***	-0.2035***	-0.0896***	0.1707***	0.1387***	1.0000

PRO_1 and PRO_2 denote the gross operating income and the net operating income, respectively. CCC is the Cash Conversion Cycle; SIZE the size; GROWTH the growth of sales; and LEV the leverage.
*Indicates significance at 10% level;**indicates significance at 5%level; ***indicates significance at 1% level.

Table 4
Estimation results of Cash Conversion Cycle-profitability relation

$$(PRO_1)_{i,t} = \beta_0 + \beta_1 PRO_{i,t-1} + \beta_2 CCC_{i,t} + \beta_3 CCC^2_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t} \quad (1a)$$

$$(PRO_2)_{i,t} = \beta_0 + \beta_1 PRO_{i,t-1} + \beta_2 CCC_{i,t} + \beta_3 CCC^2_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t} \quad (1b)$$

	Equation (1a)	Equation (1b)
$PRO_{i,t-1}$	0.4444***	0.4610***
	(6.95)	(7.18)
$CCC_{i,t}$	-0.0327***	-0.0312***
	(-2.94)	(-2.97)
$CCC^2_{i,t}$	-0.0070*	-0.0065*
	(-1.80)	(-1.74)
SIZE	0.0493	0.0565
	(1.01)	(1.22)
GROWTH	0.0381	0.0325
	(0.80)	(0.70)
LEV	0.1175	0.1202
	(0.95)	(1.02)
m_2	1.06	0.77
Hansen Test	63.70(50)	60.17(50)
Observations	3846	3846

The dependent variable is the gross operating income in equation (1a) and the net operating income in equation (1b). CCC is the Cash Conversion Cycle divided by 100 and CCC^2 its square; SIZE the size; GROWTH the growth of sales; and LEV the leverage. Time and industry dummies are included in the estimations, but not reported.
Z statistic in brackets.
*Indicates significance at 10% level;**indicates significance at 5%level; ***indicates significance at 1% level.
m_2 is a serial correlation test of second-order using residuals of first differences, asymptotically distributed as N(0,1) under null hypothesis of no serial correlation. Hansen test is a test of over-identifying restrictions distributed asymptotically under null hypothesis of validity of instruments as Chi-squared. Degrees of freedom in brackets.

Table5
Sub-samples by industry
Estimation results of Cash Conversion Cycle-profitability relation

$$(PRO_1)_{i,t} = \beta_0 + \beta_1 PRO_{i,t-1} + \beta_2 CCC_{i,t} + \beta_3 CCC^2_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t}$$

	Agriculture and Mining sectors	Construction sector	Wholesale and Retail trade sectors	Service and Transport sectors
$PRO_{i,t-1}$	0.3440	-0.0136	0.0547	0.1878***
	(1.45)	(-0.34)	(0.68)	(5.50)
$CCC_{i,t}$	0.0225	-0.0546***	-0.0654**	-0.0189***
	(0.41)	(-6.03)	(-2.56)	(-3.92)
$CCC^2_{i,t}$	-0.0048	-0.0093**	-0.0130**	-0.0110***
	(-0.47)	(-2.42)	(-1.97)	(-9.88)
SIZE	0.0790	-0.1344***	-0.0339	-0.0319
	(0.82)	(-5.92)	(-1.28)	(-1.60)
GROWTH	0.1735*	0.0771***	0.0267	0.0925***
	(1.80)	(6.29)	(0.50)	(3.82)
LEV	-0.7767	-1.0048***	-0.3012*	-0.5986***
	(-7.49)	(-6.82)	(-1.83)	(-8.02)
m_2	-1.51	-1.27	-0.86	-1.28
Hansen Test	9.39(41)	51(41)	47.01(34)	50.19(50)
Observations	59	317	1351	365

The dependent variable is the gross operating income. CCC is the Cash Conversion Cycle divided by 100 and CCC^2 its square; SIZE the size; GROWTH the growth of the sales; and LEV the leverage. Time and industry dummies are included in the estimations, but not reported.
Z statistic in brackets.
*Indicates significance at 10% level;**indicates significance at 5%level; ***indicates significance at 1% level.
m_2 is a serial correlation test of second-order using residuals of first differences, asymptotically distributed as N(0,1) under null hypothesis of no serial correlation. Hansen test is a test of over-identifying restrictions distributed asymptotically under null hypothesis of validity of instruments as Chi-squared. Degrees of freedom in brackets.

Table 6

Estimation results of deviations from optimal Cash Conversion Cycle-profitability relation

$$(PRO_1)_{i,t} = \alpha_0 + \alpha_1 PRO_{i,t-1} + \alpha_2 Deviation_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 GROWTH_{i,t} + \alpha_5 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t} \quad (3a)$$

$$(PRO_2)_{i,t} = \alpha_0 + \alpha_1 PRO_{i,t-1} + \alpha_2 Deviation_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 GROWTH_{i,t} + \alpha_5 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t} \quad (3b)$$

$$(PRO_1)_{i,t} = \gamma_0 + \gamma_1 PRO_{i,t-1} + \gamma_2 Deviation_{i,t} + \gamma_3 (Deviation*AOD)_{i,t} + \gamma_4 SIZE_{i,t} + \gamma_5 GROWTH_{i,t} + \gamma_6 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t} \quad (4a)$$

$$(PRO_2)_{i,t} = \gamma_0 + \gamma_1 PRO_{i,t-1} + \gamma_2 Deviation_{i,t} + \gamma_3 (Deviation*AOD)_{i,t} + \gamma_4 SIZE_{i,t} + \gamma_5 GROWTH_{i,t} + \gamma_6 LEV_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t} \quad (4b)$$

	PRO_1		PRO_2	
	Equation (3a)	Equation (4a)	Equation (3b)	Equation (4b)
$PRO_{i,t-1}$	0.2560***	0.3055***	0.2814***	0.3299***
	(2.79)	(3.71)	(3.07)	(4.09)
Deviation	-0.0321**	-0.0328*	-0.0275*	-0.0298*
	(-2.14)	(-1.73)	(-1.90)	(-1.66)
(Deviation*AOD)		-0.0104		-0.0239
		(-0.31)		(-0.70)
SIZE	0.1115**	0.1045*	0.1068**	0.0188
	(2.00)	(1.93)	(2.02)	(0.29)
GROWTH	0.0188	0.0892	0.0157	0.1078*
	(0.29)	(1.46)	(0.26)	(1.84)
LEV	-0.0562	-0.0689	-0.0194	-0.0326
	(-0.40)	(-0.51)	(-0.14)	(-0.26)
F		2.74		3.94
m_2	-0.08	0.22	-0.23	-0.07
Hansen Test	45.88(41)	58.36(50)	43.89(41)	53.68(50)
Observations	3846	3846	3846	3846

The dependent variable in equations (3a) and (4a) is the gross operating income. The dependent variable in equations (3b) and (4b) is the net operating income. Deviation denotes the deviations from optimal CCC; (Deviation*AOD) the interaction term; SIZE the size; GROWTH the growth of sales; and LEV the leverage. Time and industry dummies are included in the estimations, but not reported.

Z statistic in brackets.

*Indicates significance at 10% level;**indicates significance at 5%level; ***indicates significance at 1% level.

F is the F-test for the linear restriction test under the null hypothesis Ho: $\gamma_2 + \gamma_3 = 0$ in equations (4a) and (4b).

m_2 is a serial correlation test of second-order using residuals of first differences, asymptotically distributed as N(0,1) under null hypothesis of no serial correlation. Hansen test is a test of over-identifying restrictions distributed asymptotically under null hypothesis of validity of instruments as Chi-squared. Degrees of freedom in brackets.

APPENDIX 1

Table 7
Mean and median values of firms' characteristic by size and sector

Panel A (Small Firms)

Small firms	Number of firms	PRO_1	PRO_2	CCC	LNSALES	EMPLOYEES	GROWTH	LEVERAGE	AGE
Agriculture and Mining	6	0.4603	0.4110	54.0463	9.1245	19.5143	0.0499	0.6271	15.4
		(0.4634)	(0.3953)	(44.4227)	(9.2233)	(18)	(0.0445)	(0.6926)	(15)
Manufacturing	154	0.4648	0.4224	85.7845	9.1882	34.3322	0.0762	0.6185	23.6509
		(0.4532)	(0.4068)	(76.4552)	(9.135)	(35.6667)	(0.0557)	(0.6381)	(21)
Construction	22	0.3456	0.3313	49.4326	9.3947	39.2385	0.1272	0.7022	19.3692
		(0.3163)	(0.3018)	(51.3559)	(9.33)	(44.1667)	(0.1153)	(0.735)	(19)
Wholesale trade	181	0.3826	0.3658	102.5029	9.4155	27.6727	0.0673	0.6592	22.1445
		(0.3517)	(0.3337)	(91.7410)	(9.3639)	(28.4)	(0.0499)	(0.6841)	(20)
Retail trade	54	0.4466	0.4240	63.5182	9.2671	34.1812	0.0639	0.6821	21.2168
		(0.4383)	(0.4143)	(53.2758)	(9.325)	(36.6667)	(0.0442)	(0.7053)	(19)
Services	7	0.5199	0.4661	-6.3258	9.2371	35.079	0.0509	0.5455	18.5526
		(0.4436)	(0.3756)	(8.0093)	(9.2033)	(35.8333)	(0.0514)	(0.5625)	(17.5)
Transport	13	0.5273	0.4607	0.0008	9.3125	34.1974	0.0639	0.6636	18.1579
		(0.5431)	(0.4529)	(12.3988)	(9.1857)	(35.1667)	(0.0479)	(0.655)	(18)
Total	437	0.4250	0.3961	83.6932	9.3065	31.6045	0.0725	0.6479	22.1485
		(0.4079)	(0.3751)	(71.5187)	(9.2598)	(33.3667)	(0.0512)	(0.6734)	(20)

This table shows the mean (median) values of firms' characteristics by size and sector. Panel A presents values for small firms. Values for medium firms are in Panel B.
PRO_1 and PRO_2 denote the gross operating income and the net operating income, respectively. CCC is the Cash Conversion Cycle; LNSALES is the natural logarithm of sales; EMPLOYEES is the number of employees; GROWTH the growth of sales; LEVERAGE the leverage; and AGE the firm age.

Table 7 (continued)
Mean and median values of firms' characteristic by size and sector

Panel B (Medium firms)

Medium firms	Number of firms	PRO_1	PRO_2	CCC	LNSALES	EMPLOYEES	GROWTH	LEVERAGE	AGE
Agriculture and Mining	9	0.5319	0.4717	38.8775	9.4003	91.9815	0.0441	0.5011	24.0556
		(0.5559)	(0.5014)	(37.9381)	(9.4997)	(86.3333)	(0.0352)	(0.4456)	(17.5)
Manufacturing	305	0.5653	0.5144	96.9889	9.5217	95.737	0.0706	0.5953	26.3565
		(0.5363)	(0.4888)	(91.4651)	(9.5422)	(87.6667)	(0.0606)	(0.6087)	(23)
Construction	59	0.5883	0.5633	41.9934	9.3994	103.1272	0.1194	0.7318	21.4422
		(0.5079)	(0.4856)	(32.1841)	(9.384)	(87.6667)	(0.0967)	(0.7765)	(20)
Wholesale trade	79	0.4626	0.4362	87.8995	9.8003	84.1724	0.0666	0.6663	24.9246
		(0.4123)	(0.3845)	(86.2981)	(9.7995)	(74.3333)	(0.0596)	(0.6976)	(21)
Retail trade	42	0.4895	0.4608	75.2981	9.8018	75.0947	0.0646	0.6487	23.0576
		(0.4411)	(0.4233)	(63.2644)	(9.888)	(62)	(0.0488)	(0.6995)	(20)
Services	54	0.6466	0.5941	-40.8534	9.009	122.0774	0.0835	0.5554	21.5161
		(0.5880)	(0.5297)	(-47.6891)	(8.9436)	(112.6833)	(0.067)	(0.565)	(19)
Transport	23	0.6987	0.6315	-14.5281	9.4485	96.5259	0.0897	0.6615	23.3852
		(0.6676)	(0.5950)	(9.7566)	(9.4839)	(89.6667)	(0.0731)	(0.6684)	(21)
Total	571	0.5603	0.5161	70.2022	9.5156	95.8101	0.0762	0.6207	24.8014
		(0.5189)	(0.4768)	(68.5706)	(9.5568)	(86)	(0.0617)	(0.6416)	(21)

This table shows the mean (median) values of firms' characteristics by size and sector. Panel A presents values for small firms. Values for medium firms are in Panel B.
PRO_1 and PRO_2 denote the gross operating income and the net operating income, respectively. CCC is the Cash Conversion Cycle; LNSALES is the natural logarithm of sales; EMPLOYEES is the number of employees; GROWTH the growth of sales; LEVERAGE the leverage; and AGE the firm age.