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Long-Term Debt and the Value of the Firm: Evidence from International Listed Manufacturing Firms

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Abstract: The goal of this study is to investigate the impact of long-term debt on the value of the firm for international listed manufacturing firms. The testing period is based on quarterly data from 1999 to 2009, while 346 internationally listed firms are employed. The methodologies are those of panel co-integration and panel causality. The empirical findings show that long-term leverage obligations have a negative and statistically significant impact on the value of the firm. The impact, however, is differentiated with respect to the size of the firm as well as with the type of long-term investment the long-term debt is spent. The implications are crucial, since managers may manipulate such leverage funds in such a manner that they do not satisfy the long-run fixed capital investment objectives of the firm.

JEL Classification: G10, M41, C33

Keywords: Long-term debt, International manufacturing firms, Value of the firm, Panel co-integration

1. Introduction and Literature

Over the recent years with the development of multi-national firms with various operations and different types of management a critical question arises on whether the General Principles of Financial Management are still in action. One of the most important of those principles is that the role of long-term debt seems to be similar to the role of shareholder's equity capital. The amortization payment of long term assets must be financed by earnings and to that reason it is not proper to finance long-term assets with short-term liabilities. In additional, the short-term debt must be financed by current assets, while interest expenses must be finances by earnings. Thus, the behaviour of long-term debt is an important field of research. Barcley and Smithfind (1995a; b) find that firms with few growth options are large and have more long-term debt in their capital structure. Caprio and Deminrguc-Kunt (1998) find that long-term finance is associated with higher productivity. Masulis (1983) shows that changes in leverage are positively related to changes in stock returns. He makes use of daily stock returns following exchange offers and re-capitalizations where re-capitalizations occur at a single time. Bhandari (1988) indirectly tests the second of Modigliani and Miller's (1958; 1963) propositions by examining whether expected common stock returns are positively related to the ratio of debt in the cross-section of all firms, without assuming various industry-defined risk classes. His results provide evidence that leverage has a significant positive effect on expected common stock returns. Kee (1998) finds that the firm with a higher asset diversification and a larger fixed asset ratio tends to use more long–term debt, while firms in

regulated industries use more long-term debt. In the relevant literature there have been numerous studies that examine the impact of leverage levels on the value of the firm. The generated results are often mixed.

Alternative studies find a negative relationship between leverage and stock returns. Dimitrov and Jain (2006) measure the effect of leverage changes on stock returns as well as on earnings-based measures of performance. Their results reveal a negative correlation between debt-to-equity ratio and risk-adjusted stock returns. DeAngelo *et al.* (2006) maintain that although high leverage mitigates agency problems, it also reduces financial flexibility, in which case the relationship under study may be negative. George and Hwang (2010) argue that the negative relationship is due to the sensitivity of high leverage companies to financial distress risk. Muradoglu and Sivaprasad (2009) show that equity returns increase in leverage for some risk classes and decrease in leverage for others. Firms in the majority of industries experience abnormal returns that decrease in leverage, which supports the findings of authors using mixed samples of firms. Hamada (1969) and Conine (1980) show that if the CAPM holds, betas should increase in financial leverage by an arbitrage mechanism. This rationale can be extended to show that all factor loadings in a multifactor model should increase in financial leverage. Kaplan and Stein (1990) find that asset betas seem to have decreased after the increase in financial leverage, while Grullon and Michaely (2004) argue that asset betas must have declined in a sample of share repurchase programs (which effectively increase leverage).

The primary objective of this study is to investigate the relationship between long-term debt and the value of the firm with data from internationally listed industries. The novelties of the paper come from the employment of panel data methodologies as well as from the fact that, for the first time, an explicit differentiation between different uses of long-term leverage by the firm itself is also employed to clarify the sign of the relationship between this type of debt and the value of the firm. Section 2 provides a description of the methodology. Section 3 describes the data, while Section 4 reports the empirical findings, with concluding remarks are given in Section 5.

2. Methodology

The focus of the empirical analysis is the impact of long-term debt on the value of internationally listed manufacturing firms. Our benchmark model is expressed as:

$$PE_t = a_0 + a_1\, LD_t + a_2\, BV_t/MV_t + a_3\, CAP_t + a_4\, NI_t + u_t$$

where PE=the price earnings ratio, LD=long-term debt/assets, CAP=the size of the firm captured by the capitalization value/assets, BV/MV=the book value over the market value ratio and NI= the firm's profitability/assets as it is proxied by net income. u's are random variables, i.e. white noises with $N(0, \sigma^2)$. Coefficients a_2 and a_4 are expected to be positive (Easton and Zmijewski, 1989). Variables, such as BV/MV, CAP/Assets and NI/Assets are used as control variables. Rosemberg *et al.* (1985) and Chan *et al.* (1991) provide evidence that stocks with high ratios of book-to-market value of common equity have significantly higher stock returns. According to Easton and Harris (1991), the BV-to-MV ratio is a stock variable indicating the wealth of the firm's equity holders. Given the presence of heterogeneity in both dynamics and error variances in the panel, the heterogeneous panel co-integration test advanced by Pedroni (1999; 2004) is employed as follows:

$$PE_{it} = a_0 + \alpha_{it} + \delta_i t + a_1\, LD/_{it} + a_2\, BV_{it}/MV_{it} + a_3\, CAP_{it} + a_4\, NI_{it} + u_{it}$$

where $i = 1,...,N$ for each firm in the panel and $t = 1,...,T$ refers to the time period. The parameters α_i and δ_i allow for firm-specific fixed effects and deterministic trends, respectively. To test the null hypothesis of no co-integration, $\rho_i = 1$, the following unit root test is conducted on the

residuals as follows: $u_{it} = \rho_i u_{it-1} + w_{it}$. Pedroni (1999; 2004) proposes seven tests for co-integration.

3. Data

Our 346 sample of manufacturing firms are derived from five international stock exchanges, i.e. the NYSE, London, Frankfurt, Hong Kong and Tokyo. The sample spans the period 1999-2009 on a quarterly basis. This selection procedure results in a sample of 15,224 observations. Variables, such as long-term debt (LDEBT), the size of the firm captured by the capitalization value (CAP), the book value over the market value ratio (BV-MV), the price earnings ratio (PE) and firm's profitability (NI) as it is proxied by net income are obtained from Bloomberg. Long-term debt, capitalization and profitability have been scaled by dividing by total assets. All firms are listed a quarter before the testing period. To remove the inflation effect, all variables are deflated by the average quarterly consumer price index. All variables are expressed in U.S. dollars. Lower case letters denote variables expressed in natural logarithms, while the RATS (version 6.1) assisted the empirical analysis.

4. Empirical Analysis

4.1 Dynamic heterogeneity

An issue that it is of major concern is the heterogeneity of the firms included in this data set. In the statistical framework of this study we first test for heterogeneity and then by controlling for it through appropriate techniques (Holtz *et al*., 1985; Holtz-Eakin, 1986). The results are reported in Table 1. The empirical findings show that the relationship under investigation is characterized by heterogeneity of dynamics and error variance across groups, supporting the employment of panel analysis.

Table 1. Tests of dynamic heterogeneity across groups

Specification	ADF(3)	AR(3)	White's Test
	29.63*	38.44*	76.16*

ADF(3) reports the parameter equality test (F-test) across all relationships in the panel. AR(3) displays the F-test of parameter equality conducted in a third-order autoregressive model of the relationships. White's test reports the White's test of equality of variances across the investigated relationships in the panel. Model contains only operating earnings, while Model 2 contains both types of earnings.
* statistical significance at 1%.

4.2 Panel unit root tests

There are a variety of panel unit root tests which include Maddala and Wu (1999), Breitung (2000), Hadri (2000), Choi (2001), Levin *et al.* (2002), Im *et al.* (2003), and Carrion-i-Silvestre *et al.* (2005). The Im *et al.* (IPS, 2003) panel unit root test is utilized which allows for heterogeneous autoregressive coefficients. The LLC test allows heterogeneity of individual deterministic effects and heterogeneous serial correlation structure of the error terms assuming homogeneous first order autoregressive parameters. Maddala and Wu (1999) suggest a non-parametric test (Fisher-ADF test), which is based on a combination of the p-values of the t-statistics for a unit root in each cross-sectional unit. The Hadri Lagrange Multiplier (LM) test is closely related to that of the Carrion-i-

Silvestre *et al.* test. A consistent estimator of the above variance is obtained using again the estimators provided by Newey and West (1994). The results in Table 2 point out that all variables contain a unit root at the 1% level in all tests, suggesting that the log variables in our study are I(1).

Table 2. Panel unit root tests

IPS Panel Unit Root Tests		
Variables	Without Trend	With Trend
pe	-1.30(4)	-1.46(4)
Δpe	-5.39(2)*	-5.65(3)*
ldebt	-1.14(3)	-1.52(3)
Δldebt	-4.97(2)*	-5.19(2)*
cap	-1.03(3)	-1.46(3)
Δcap	-4.12(2)*	-4.68(2)*
bv-mv	-1.07(3)	-1.33(3)
Δbv-mv	-5.21(1)*	-5.84(2)*
ni	-1.19(3)	-1.66(3)
Δni	-4.89(2)*	-5.11(2)*
cp	-1.23(3)	-1.45(3)
Δcp	-5.48(2)*	-6.02(2)*
r	-1.44(3)	-1.68(3)
Δr	-5.36(1)*	-5.48(1)*

LLC Panel Unit Root Tests	
Variables	
pe	-1.41
Δpe	-9.36*
ldebt	-1.46
Δldebt	-8.63*
cap	-1.51
Δcap	-10.33*
bv-mv	-1.77
Δbv-mv	-9.58*
ni	-1.56
Δni	-8.92*
cp	-1.41
Δcp	-7.65*
r	-1.48
Δr	-7.28*

Handri (hom) Panel Unit Root Tests	
Variables	
pe	27.81*
Δpe	1.75
ldebt	9.84*
Δldebt	1.37
cap	19.41*

Δcap	1.77
bv-mv	25.32*
Δbv-mv	1.43
ni	25.69*
Δni	1.83
cp	31.83*
Δcp	1.35
r	34.82*
Δr	1.21

Handri (het) Panel Unit Root Tests

Variables	
pe	28.25*
Δpe	1.67
ldebt	9.56*
Δldebt	1.83
cap	9.62*
Δcap	1.29
bv-mv	18.58*
Δbv-mv	1.65
ni	31.44*
Δni	1.82
cp	37.64*
Δcp	1.25
r	39.50*
Δr	1.23

Fisher-ADF

Variables	
pe	17.35
Δpe	121.26*
ldebt	21.11
Δldebt	118.09*
cap	16.12
Δcap	92.36*
bv-mv	14.58
Δbv-mv	114.46*
ni	18.44
Δni	117.65*
cp	19.34
Δcp	112.73*
r	14.82
Δr	117.64*

Fisher-PP

Variables	
pe	31.36

Δpe	152.75*
ldebt	31.26
Δldebt	143.68*
cap	25.64
Δcap	147.41*
bv-mv	24.43
Δbv-mv	141.24*
ni	28.94
Δni	148.93*
cp	24.62
Δcp	135.98*
r	24.77
Δr	137.46*

Numbers in parentheses are the augmented lags include the unit root test.
* statistical significance at 1%

4.3 Panel co-integration tests

Based on the model specification presented above, Table 3 reports Pedroni (1999, 2004) panel co-integration test statistics. All seven test statistics reject the null hypothesis of no co-integration at the 1% significance level.

Table 3. Panel co-integration tests

All firms	
Panel v-stat	47.64668*
Panel rho-stat	-41.73244*
Panel pp-stat	-49.57522*
Panel adf-stat	-2.19709*
Group rho-stat	-41.26189*
Group pp-stat	-55.49559*
Group adf-stat	-3.01681*
Large firms	
Panel v-stat	49.44821*
Panel rho-stat	-44.83392*
Panel pp-stat	-53.18520*
Panel adf-stat	-3.57498*
Group rho-stat	-47.88542*
Group pp-stat	-56.12558*
Group adf-stat	-3.46773*
Small firms	
Panel v-stat	42.11832*
Panel rho-stat	-40.48339*
Panel pp-stat	-43.12287*

Panel adf-stat	-2.55934*
Group rho-stat	-40.32908*
Group pp-stat	-48.29884*
Group adf-stat	-3.12873*

* statistical significance at 1%

Following Pedroni (2000), the fully modified OLS (FMOLS) methodological approach for heterogeneous co-integrated panels is followed. Table 4 displays the FMOLS results. The coefficients have the expected theoretical signs, except for the case of the coefficient of long-term debt in which it turns out negative. The results display that 1% increase in long-term debt leads to a 0.20% decrease in the value of the firm. Moreover, size is displayed to be an important factor. The sign is negative, implying that smaller firms enjoy a higher value, and vice versa. These findings lead us to repeat the empirical analysis by splitting our sample into big and small firms.

Table 4. FMOLS estimates

All firms

pe = 0.076 - 0.204 ldebt - 0.0386 cap + 0.23 bv-mv + 0.037 ni
(1.06) (-41.6)* (-82.3)* (17.8)* (18.7)*
$\bar{R}^2 = 0.46$

Large firms

pe = 0.057 - 0.188 ldebt + 0.217 bv-mv + 0.046 ni
(1.11) (-23.5)* (14.9)* (15.2)*
$\bar{R}^2 = 0.54$

Small firms

pe = 0.046 + 0.219 ldebt + 0.247 bv-mv + 0.058 ni
(1.16) (32.5)* (20.3)* (15.4)*
$\bar{R}^2 = 0.49$

Note: t-statistics are reported in parentheses.
* significance at 1%

4.4 Error correction estimates and causality

A panel vector error correction model is estimated to perform causality tests. Table 5 reports the results of these causality tests. They show that long-term debt determines stock returns in the short-run. Wald testing, with a p-value=0.00, shows that long-term debt causes the value of the firm. The sum of the lagged coefficients for short-run changes is negative (-0.023) and statistically significant. In the long-run, the error correction term is negative, implying that following a long-term debt shock, the value of the firm adjusts to its mean by 27% every quarter. Looking at the model's overall performance, the equations satisfy certain econometric criteria, namely absence of serial correlation (LM test) and absence of functional misspecification (RESET test). The results also accept the hypothesis that ARCH effects are not present.

Overall, the empirical findings demonstrate that although long-term debt is a significant factor for the value of the firm, its size indicates that long-term leverage exerts a negative impact on

the firm's value, implying that long-term borrowing is turned away from financing fixed capital investment projects.

Table 5. Panel causality test results

Dependent Variable	Sources of Causation (Independent Variables) Short-run				Long-Run
All firms					
	Δpe	Δldebt	Δcap	Δbv-mv	Δni	λ
Δpe	----	65.90(-0.023) [0.00] [0.00]	14.54(0.033) [0.00] [0.00]	7.21(0.049) [0.00] [0.00]	155.3(0.029) [0.00] [0.00]	-0.267 [0.00]
LM	2.23[0.22]					
RESET	1.31[0.18]					
ARCH(1)	0.67[0.26]					
ARCH(4)	0.49[0.32]					
ARCH(8)	0.41[0.35]					
ARCH(12)	0.25[0.28]					
Large firms						
	Δpe	Δldebt		Δbv-mv	Δni	λ
Δpe	----	54.62(-0.027) [0.00] [0.00]		11.54(0.058) [0.00] [0.00]	86.4(0.037) [0.00] [0.00]	-0.228 [0.00]
LM	2.19[0.25]					
RESET	1.18[0.23]					
ARCH(1)	0.77[0.29]					
ARCH(4)	0.63[0.38]					
ARCH(8)	0.49[0.37]					
ARCH(12)	0.29[0.29]					
Small firms						
	Δpe	Δldebt		Δbv-mv	Δni	λ
Δpe	----	60.18(0.034) [0.00] [0.00]		12.84(0.040) [0.00] [0.00]	109.4(0.033) [0.00] [0.00]	-0.206 [0.00]
LM	2.08[0.25]					
RESET	1.43[0.15]					
ARCH(1)	0.83[0.23]					
ARCH(4)	0.38[0.28]					
ARCH(8)	0.46[0.37]					
ARCH(12)	0.43[0.32]					

Wald F-tests reported with respect to short-run changes in the independent variables. The sum of the lagged coefficients for the respective short-run changes is denoted in parentheses. λ represents the coefficient of the error correction term, while values in brackets denote p-values. LM is a serial correlation test, RESET is a functional misspecification test and ARCH is an ARCH test at 1, 4, 8, and 12 lags.

* statistical significance at 1%

4.5 The role of size

Based on the median criterion, we get two samples: the first contains 213 firms characterized as large firms and the second contains 131 firms characterized as small firms. Table 3 reports panel co-integration tests. In both cases all seven test statistics reject the null hypothesis of no co-integration. Table 4 displays FMOLS results. The coefficient of long-term debt shows a differential behaviour with respect to the size of firms. For large firms the coefficient is negative, while for small firms the coefficient is positive. Table 5 reports the causality test results. They indicate that long-term debt has a differential effect on the value of the firm, depending on its size. For large firms, Wald testing shows that long-term debt provides significant information for the value of the firm. The sum of the lagged coefficients for short-run changes retains its negative sign (-0.027), while it is statistically significant. The error correction term is negative, implying that following a long-term debt shock, the value of the firm adjusts to its mean by 23% every quarter. By contrast, for small firms, although Wald testing continues to support that long-term debt remains an important information provider for the value of the firm, the sum of lagged coefficients is positive (0.034). Finally, the error correction term is negative, implying that following a long-term debt shock, the value of the firm adjusts to its mean by 21% every quarter.

Overall, the empirical findings demonstrate that long-term debt is handled by small firms in such a way that its disposition contributes to a higher firm's value. The opposite occurs for large firms. To shed light to this differential behaviour we turn into investigating the association of long-term debt to specific items of the firm's balance, such as fixed capital and other long-term investment assets.

4.6 Long-term debt and types of long-term assets

This section includes two types of long-term investment assets, fixed capital and other long-term investments, i.e. participations or merging & acquisitions activities, plus two macroeconomic variables, i.e. consumer prices and the central bank's discount rate, to control for the macroeconomic environment. The discount rate reflects developments both in monetary policy and in credit conditions (Kashyap *et al.*, 1993), while consumer prices reflect the course of monetary policy. We expect negative correlations with both of these two variables, as higher consumer prices and interest rates reflect tighter credit conditions, thus, bad news for future profits.

Panel unit roots for both consumer prices and the discount rate (Table 2) recommend that both variables are I(1). Table 6 reports panel co-integration test statistics and for two cases: the first with the long-term debt spent on fixed capital assets and the second with the long-term debt spent on other long-term investments. In both cases, all statistics reject the null hypothesis of no co-integration.

Table 6. Panel co-integration tests (The extended regression model)

With long-term debt on fixed capital	
Panel v-stat	56.38951*
Panel rho-stat	-51.50963*
Panel pp-stat	-52.68821*
Panel adf-stat	-4.48932*
Group rho-stat	-51.27836*
Group pp-stat	-54.97034*
Group adf-stat	-5.02366*

With long-term debt on other long-term investments

Panel v-stat	45.80452*
Panel rho-stat	-40.44926*
Panel pp-stat	-41.35612*
Panel adf-stat	-5.44985*
Group rho-stat	-40.49023*
Group pp-stat	-43.59822*
Group adf-stat	-5.77437*

* statistical significance at 1%

Table 7 displays FMOLS results. The coefficients have the expected theoretical signs; however, this time where long-term debt is spent on fixed capital, the coefficient of long-term debt is positive, while where this long-term debt is associated with spending on other long-term investments the coefficient is negative. These findings indicate that participants in the market perceive the association of long-term debt with spending on long-term investments as a signal of risky business for the firm, leading to a lower value. By contrast, the coefficient is positive when the long-term debt is associated with spending on fixed capital, signalling that debt is not a risky factor for the firm if it is spent on such investment activities.

Table 7. FMOLS estimates (The extended regression model)

With long-term debt on fixed capital (ldebt1)

pe = 0.095 + 0.134 ldebt1 - 0.179 cap + 0.321 bv-mv + 0.024 ni – 0.148 cp– 0.095 r
(1.18) (8.22)* (-87.9)* (5.38)* (13.4)* (-27.8)* (-7.11)*

$\bar{R}^2 = 0.65$

With long-term debt on other long-term investments (ldebt2)

pe = 0.048 - 0.114 ldebt2 - 0.163 cap + 0.268 bv-mv + 0.039 ni – 0.157 cp – 0.117 r
(0.79) (-9.33)* (-41.2)* (7.61)* (10.5)* (-15.4)* (-8.43)*

$\bar{R}^2 = 0.58$

Note: t-statistics are reported in parentheses.
* significance at 1%

5. Concluding Remarks and Implications

This paper investigated the role of long-term debt on the value of the firm. A panel sample of 346 firms was used over the time span 1999-2009. Through panel co-integration, the empirical findings showed that long-term debt exerted a negative effect on the firm's value. Our results support the contention that long-term debt is handled by small firms in such a way that its disposition contributes to a higher value. The opposite occurs with large firms. Finally, the results displayed that market participants believe that long-term debt spent on other long-term investments but not on fixed capital is perceived as a risky business, leading to a lower value of the firm. By contrast, when the long-term debt is associated with spending on fixed capital, then it is not perceived as a risky factor for the firm. The implications of the results are very crucial to regulators, since managers may manipulate firms' long-term leverage satisfying their own objectives and jeopardising firm's stock prices. An area for future research would be to identify other variables associated with explicit types of long-term debt spending, published in firms' financial statements, which would help analysts determine any potential impact of such items on the firm's value.

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