Leverage and Corporate Performance: A Frontier Efficiency Analysis

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Abstract

This paper aims to provide new empirical evidence on a major corporate governance issue: the relationship between leverage and corporate performance. We bring two major improvements to this literature by applying frontier efficiency techniques to obtain performance measures for companies from several countries (France, Germany and Italy). We then proceed to regressions of corporate performance on a various set of variables including leverage. We found mixed evidence depending on the country: while significantly negative in Italy, the relationship between leverage and corporate performance is significantly positive in France and Germany. This tends to support the influence of some institutional characteristics on this link.

Keywords: corporate governance, financial structure, frontier efficiency, leverage.
JEL Classification: G32

1. Introduction

Corporate governance literature aims to improve the understanding of the mechanisms that favor the managerial performance. A major issue in this strand of literature is the influence of financial leverage on corporate performance. Two motivations underline the interest for this issue. On one hand, this issue has some public policy considerations because of its implications on the policies promoting equity among sources of financing for companies. On the other hand, a positive relation between financial leverage and corporate performance would mean that inter-country differences in access to credit result in competitiveness advantages.

From a theoretical basis, this impact is noticeably based on the binding role of debt: debt financing raises the pressure on managers to perform, because it reduces the moral hazard behavior by reducing 'free cash-flow' at the disposal of managers

(Jensen [1986]). Consequently, the firms with the higher leverage should be the most incited to improve their performance. However, on the other side, a higher leverage means higher agency costs because of the diverging interests between shareholders and debtholders: this moral hazard problem suggests that leverage may be negatively linked to performance (Jensen and Meckling [1976], Myers [1977]). Thus, literature provides opposite arguments on the relationship between leverage and performance. A survey of the empirical literature on this debate shows the lack of consensus on the link between leverage and corporate performance. However two elements may explain this divergence. On one hand, this literature uses various measures of performance, either basic accounting ratios or more sophisticated measures such as total factor productivity indicators. Consequently, it can be argued that different results in conclusions can come from the differences in performance measures. This may also be the result of the fact that studies use non-satisfactory performance measures, as the drawbacks of raw accounting measures to evaluate corporate performance are well-known. On the other hand, all studies were only performed on one country. Consequently, the different conclusions may result from the influence of the institutional framework on the relationship.

To investigate the influence of these both elements on the observed differences about the link between leverage and performance, we aim here to provide new evidence on this relationship with two major improvements comparing to former empirical literature.

First, we use frontier efficiency techniques to estimate performance measures. Following seminal works from Aigner, Lovell and Schmidt [1977] and Charnes, Cooper and Rhodes [1978], these methods provide sophisticated performance measures, the efficiency scores, that are synthetic and relative measures of performance. In particular, these techniques present the advantage to allow the inclusion of several input and output dimensions in the evaluation of performances, unlike basic productivity measures.

Second, we proceed to an empirical work in several countries (France, Germany, Italy) to include various institutional frameworks in the analysis. Institutional factors include especially here the architecture of legal and financial systems, as La Porta et al. [1998] pointed out the role of these characteristics as determinants of the structure of financing. These both improvements allow us then to bring new robust evidence on the relationship between leverage and corporate

performance and the possible influence of the institutional framework on this issue. Our work then consists of a regression of the efficiency scores on a set of variables including leverage.

The structure of the paper is as follows. Section 2 presents the theoretical and empirical background of the relationship between financial leverage and corporate performance. Section 3 describes the data and variables. In section 4, we present the methodology used for the cost efficiency measures. Section 5 develops the empirical results. We finally provide some concluding remarks in section 6.

2. Background

2.1 Theoretical background

Though the Modigliani and Miller [1958] theorem suggested that the financial structure has no influence on firm value, a number of theoretical works have provided arguments in favor of the non-neutrality of financial structure in economic terms. Among the works contesting the relevance of Modigliani-Miller theorem, a major strand suggests a relation between leverage and corporate performance.

The studies on the link between leverage and corporate performance can in fact be classified in two categories. The first one includes the works based on information asymmetries and signalling. Firm insiders (managers or shareholders) possess some private information about the characteristics of the firm. It has then been demonstrated that these information asymmetries between borrowers and lenders induce some adverse selection problems: the impossibility of lenders to price a loan according to the borrower's quality results in an imperfect pricing, leading to credit rationing (Stiglitz and Weiss [1981]). Therefore, "high-quality" borrowers have incentives to show their quality. However, they need to provide this private information by using a credible signal, meaning a signal that can not be provided by "low-quality" borrowers. Debt can then be adopted as this signal as the choice of financing by debt rather than by equity conveys valuable information to the lenders (Leland and Pyle [1977]). In particular, Ross [1977] advanced that a "good-quality" company can issue more debt than a "low-quality" one, because the issue of debt leads to a higher probability of default due to the debt-servicing costs which represent

a costly outcome for firm insiders. As a result, debt is a credible signal of the quality of firms and "good-quality" firms are more inclined to issue debt. Thus, this theory suggests that the most performing firms, those having the more profitable investments, ask for more debt: there should then exist a positive relation between corporate performance and leverage.

The second category of studies on the relationship between leverage and corporate performance is linked to the agency costs literature. As mentioned by Jensen and Meckling [1976], significant agency costs can indeed arise from conflicts of interest between categories of agents (managers, shareholders, debtholders). These authors identify in fact two types of conflicts that have different implications leading to opposite theories on the link leverage-performance.

Firstly, agency costs result from the conflicts of interest between shareholders and managers. The key problem is here the moral hazard behavior of managers that can waste firm resources or minimize their effort rather than increasing firm value, as they have their own objectives. In this way, debt financing raises the pressure of managers to perform (meaning to reduce their waste of resources and to increase their effort) as it reduces "free cash-flow" at the disposal of managers (Jensen [1986]). Indeed, debt implies interest payment obligations that must be satisfied by managers, under the threat of a bankruptcy if these obligations are not satisfied. Grossman and Hart [1982] also argue that debt financing provides better incentives for managers to perform as they aim to avoid the personal costs of bankruptcy. Consequently there should exist a positive influence of leverage on corporate performance.

Secondly, agency costs also arise because of the conflicts of interest between shareholders and debtholders. Indeed shareholders have incentives to take actions that benefit themselves at the expense of debtholders, and consequently that do not necessarily maximize firm value. This divergence of interests has two manifestations. On one hand, it gives incentives to shareholders to invest in riskier projects than those preferred by debtholders (Jensen and Meckling [1976]). This "asset substitution' comes from the asymmetry of gains for shareholders: if an investment provides returns above the debt value, gains are for shareholders. Whereas if the investment fails, losses are shared between debtholders that do not receive the repayment and shareholders that suffer from the loss of capital, because of limited liability for shareholders. On the other hand, conflicts between shareholders and debtholders can also create underinvestment, as demonstrated by Myers [1977]. As a result, the

agency costs resulting from the conflicts of interest shareholders-debtholders suggest that a higher leverage is correlated with a lower corporate performance.

To sum it up, theoretical literature provides opposite arguments on the relationship between leverage and corporate performance. Whereas theories based on signalling and the agency costs resulting from the conflict of interests shareholders-managers provide arguments in favor of a positive relation, the stream of research analyzing the agency costs from the diverging interests between shareholders and debtholders suggests a negative relation. Therefore, has empirical literature decided between theories?

2.2 A short review of the empirical literature

A few empirical studies have been performed to analyze the relationship between leverage and corporate performance. The major difference between them is based on the definition of corporate performance. There is a first strand of papers using basic accounting measures of performance. Majumdar and Chhibber [1999] test the relationship between leverage and corporate performance on a sample of Indian companies. Adopting an accounting measure of profitability, return on net worth, to evaluate performance, they observe a significant negative link between leverage and corporate performance. Kinsman and Newman [1999] use various measures of performance on this issue on a sample of US firms, based on accounting or ownership information (firm value, cash-flow, liquidity, earnings, institutional ownership and managerial ownership). They perform regressions of leverage on this set of performance measures. Their conclusion is the existence of robust relationships between leverage and some of the measures of performance such as a negative link with firm value and cash-flow. However this work is criticized with the use of very contested performance measures such as liquidity, but also with their joint inclusion in regressions, mixing their influence.

In this field, we can also mention a couple of empirical works that focus on the determinants of leverage and test the profitability variable. It has to be underlined however that profitability can not be strictly considered as a performance variable to explain the leverage, as profitability is the source of internal financing. As a result, there is a negative impact of profitability on leverage, as a higher profitability means a

lesser need for external financing such as financial debt. Here the conclusion is clearly a negative relationship between profitability and leverage (Rajan and Zingales [1995], Johnson [1997], Michaelas et al. [1999]).

There is however a second strand of works on the relationship between leverage and corporate performance that develop more sophisticated measures of performance. Pushner [1995] aims to analyze the relationship between leverage and corporate performance in concordance with the influence of equity ownership in Japan. Corporate performance is here measured by total factor productivity: a production frontier is estimated, in which performance is equal to the residual of OLS estimate. He concludes to a negative relationship between leverage and corporate performance. Two studies test the role of financial pressure on corporate performance, which is a closely related issue. Both analyze data on the United Kingdom and measure again corporate performance as total factor productivity. Nickell et al. [1997] observe a positive link between financial pressure and productivity growth. Nickell and Nicolitsas [1999] conclude to a weak positive effect of financial pressure on productivity.

To conclude this brief survey about former empirical literature, it appears that there is no consensus on the relationship between leverage and corporate performance. We observe furthermore two key elements for the understanding of the link leverage-performance. The first element is the fact that all studies test this link only in one country, which can explain the different results as the institutional framework may play a role on the relationship between leverage and corporate performance. This is the reason why we analyze in our study this relationship on several countries. The second element concerns the used measures of performance, either accounting measures of total factor productivity indicators. In the following work, we adopt frontier efficiency scores to evaluate performance. Efficiency scores own a couple of advantages in comparison of other measures of performance. Comparing to raw measures of performance, efficiency scores allow the inclusion of several outputs and inputs and provide consequently synthetic measures of performance. In comparison to all other measures of performance (raw measures or productivity measures), efficiency scores have the advantage to offer relative scores that take directly into account the comparison with the best companies.

3. Data and variables

The sample includes about 12000 manufacturing companies from three European countries: 5295 from France, 573 from Germany, 6141 from Italy. Data are unconsolidated balance sheet data. They are extracted from Amadeus database edited by Bureau Van Dijk. Our choice to work on unconsolidated balance sheet data comes from the fact that Amadeus database only provides unconsolidated data for the countries of our study. Furthermore, Rajan and Zingales [1995] pointed out that the choice of using consolidated data leads to an increase of the indebtedness ratio in the year when a firm moves to consolidate accounts. We limited the analysis to manufacturing companies to have a homogenous sample in terms of financial structure. In this aim, we selected companies with CSO code between 2000 and 4999.

Our selection of variables includes chosen input prices, input and output quantities for the cost efficiency estimation of cost efficiency frontiers, and control variables for the regression model of corporate performance. The definition of inputs and outputs for the cost efficiency frontier includes one output (turnover) and two inputs (labor and physical capital). The price of labor is measured by the ratio of personnel expenses on number of employees. The price of physical capital is defined as the ratio of other non-interest expenses (including depreciation) on fixed assets. Total cost is the sum of personnel expenses, measuring labor, and other non-interest expenses, measuring physical capital.

We adopted the Turkey box-plot, based on the use of interquartile range to clean the sample data from outliers. Firms with observations out of the range defined by the first and third quartiles more or less one and half the interquartile range were excluded for the three ratios used in the analysis: price of labor, price of physical capital, leverage. Table 1 presents some descriptive statistics for our sample. We observe that the mean German company is largely bigger than the mean companies from other countries, suggesting that our German sample has a larger proportion of large companies. We observe relatively strong differences in leverage across countries: while Italian companies are the most leveraged on average (75.05%), French and German companies have very similar mean values (respectively 64.36% and 63.37%).

Table 1
Descriptive statistics for variables
Table presents the mean values for each item by country, standard deviations are given in parentheses.
All values are in millions euros, except where indicated.

	France	Germany	Italy
Number of observations	5295	573	6141
Output			
Turnover	103,002.3	927,755.8	60,241.11
	(605,774.0)	(3,983,859.5)	(357,848.8)
Inputs			
Personnel expenses	17,181.8	191,815.3	8,920.9
	(66,651.7)	(792,550.5)	(46,052.7)
Other non interest expenses	49,876.5	595,549.1	35,146.9
	(367,547.7)	(2,986,321.7)	(264,912.6)
Input prices			
Price of labor	48.30	65.49	42.33
	(13.02)	(13.59)	(9.20)
Price of physical capital	3.98	2.67	3.23
	(3.40)	(2.14)	(2.52)
Other characteristics			
Total assets	83,190.1	812,011.6	57,992.7
	(485,006.4)	(4,167,760.9)	(326,401.1)
Total cost	67,658.3	787,364.4	44,067.8
	(422,155.2)	(3,741,534.5)	(306,646.3)
Equity	31,172.4	310,979.7	14,790.4
	(194,787.2)	(1,727,163.2)	(69,540.5)
Tangibility of assets (in %)	29.46	42.56	29.98
	(16.84)	(18.35)	(15.26)
Ratio of inventory on assets (in %)	20.59	19.31	20.93
	(12.82)	(12.40)	(12.82)
Ratio of current liabilities on total liabilities (in %)	69.46	39.72	64.85
	(14.20)	(17.50)	(12.77)
Leverage (in %)	64.36	63.37	75.05
	(19.74)	(17.93)	(15.37)

Table A in Appendix describes the national samples by sector, according to the two-digit CSO code. Due to the insufficient number of observations, we cancel some

CSO sectors from our analysis as follows: CSO 21 for France, CSO 21 and 44 for Germany.

Next to the estimation of cost efficiency scores as the measure of performance, we elaborate a regression model to assess the link between leverage and corporate performance, by including some control variables. The explained variable in the regression model is the cost efficiency score as the measure of corporate performance. The main explanatory variable is LEVERAGE, defined as the ratio of total liabilities to total assets. This definition is frequently adopted in the literature on the determinants of leverage (Rajan and Zingales [1995], Michaelas et al. [1999]).

The other explanatory variables are control variables that take size and industry-related factors into account. How large a firm is can be a determinant of performance: large firms can benefit from economies of scale, or on the opposite side they can suffer from problems of coordination. We consequently use a SIZE variable, measured by the total turnover. Industry-related factors are controlled with three variables. TANGIBILITY indicates the tangibility of assets and is measured by the ratio of fixed assets to total assets, while INVENTORY indicates the share of inventories, as it is the ratio of total inventories to total assets. Additionally, we include a variable to take the term structure of liabilities: SHORT-TERM LIABILITIES, defined as the ratio of short-term liabilities to total liabilities.

4. The cost efficiency model

We use the Stochastic Frontier Approach to estimate the cost efficiency scores (Aigner et al. [1977]). This approach is frequently applied in banking (Berger and Humphrey [1997]), but also in other industries as surveyed by Lovell [1993]. In comparison to the alternative technique used to have single-year efficiency scores, Data Envelopment Analysis, the chosen approach presents the advantage of disentangle the efficiency and a statistical noise taking exogenous events into account in the residual (the distance from the efficiency frontier). It also allows an easier control of the industry-specific variables in the estimation of the efficiency frontier, which is needed to provide relatively homogenous efficiency measures.

Cost efficiency measures how close a firm's cost is to what a best-practice firm's cost would be for producing the same bundle of outputs. It then provides information on wastes in the production process and on the optimality of the chosen mix of inputs. The stochastic cost frontier methodology[2] based on a multiproduct translog cost function is adopted to calculate cost efficiency scores for the firms of each country of our sample.

The basic model assumes that total cost deviates from the optimal cost by a random disturbance, v, and an inefficiency term, u. Thus the cost function is $TC = f(Y, P) + \varepsilon$ where TC represents total cost, Y is the vector of outputs, P the vector of input prices and ε the error term which is the sum of u and v. u is a one-sided component representing cost inefficiencies, meaning the degree of weakness of managerial performance. v is a two-sided component representing random disturbances, reflecting bad (good) luck or measurement errors. u and v are independently distributed. v is assumed to have a normal distribution with zero mean and variance σ^2. Several distributions have been proposed in the literature for the inefficiency component u: half-normal, truncated normal, gamma, exponential. Here we assume a gamma distribution for inefficiency terms following Greene [1990].

According to Jondrow et al. [1982], firm-specific estimates of inefficiency terms can be calculated by using the distribution of the inefficiency term conditional to the estimate of the composite error term. Greene [1990] has then provided the estimate of the cost inefficiency term with a gamma distribution.

We estimate national frontiers rather than one common frontier to allow the comparison of firms in the same economic and institutional environment. We estimate a system of equations composed of a translog cost function and its associated input cost share equations, derived using Shepard's lemma. Estimation of this system adds degrees of freedom and results in more efficient estimates than just the single-equation cost function. Since the share equations sum to unity, we solved the problem of singularity of the disturbance covariance matrix of the share equations by omitting one input cost share equation from the estimated system of equations. Standard symmetry constraints and homogeneity conditions are imposed.

[2] See Kumbhakar and Lovell [2000] for further details on Stochastic Frontier Analysis.

Table 2
ITSUR estimation of cost function system
(i) The dependent variable is the logarithm of turnover, (ii) t-statistics are given in parentheses,
(iii) *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level,
(iv) y = turnover, p_L = price of labor, p_K = price of physical capital, CSO21-48 industry codes dummy variables

Parameter	France	Germany	Italy
Intercept	0.651 (1.18)	-0.108 (-0.09)	3.172*** (4.86)
ln y	0.382*** (3.89)	0.673*** (3.46)	-0.015 (-0.13)
(ln y)²	0.071*** (8.02)	0.033** (2.18)	0.103*** (9.46)
ln p_L	0.571*** (26.6)	0.592*** (13.04)	0.241*** (12.16)
(ln p_L)²	0.121*** (64.7)	0.044*** (8.65)	0.125*** (74.47)
ln p_K	0.429*** (19.9)	0.408*** (8.98)	0.759*** (38.39)
(ln p_K)²	0.121*** (64.7)	0.044*** (8.65)	0.125*** (74.47)
(ln p_L) (ln p_K)	-0.121*** (-64.7)	-0.044*** (-8.65)	-0.125*** (74.47)
(ln y) (ln p_L)	-0.050*** (-24.48)	-0.032*** (-9.08)	-0.032*** (-16.82)
(ln y) (ln p_K)	0.050*** (24.48)	0.032*** (9.08)	0.032*** (16.82)
CSO21	_	_	0.068 (0.24)
CSO22	-0.157** (-2.00)	-0.434* (-1.65)	0.155* (1.95)
CSO23	0.168* (1.77)	0.375 (0.98)	0.495*** (3.72)
CSO24	0.040 (0.55)	0.0801 (0.32)	0.540*** (7.14)
CSO25	-0.148* (-2.18)	-0.141 (-0.59)	0.218*** (2.94)
CSO26	-0.059 (-0.32)	0.022 (0.06)	0.487*** (2.94)
CSO31	-0.016 (-0.23)	-0.071 (-0.29)	0.360*** (4.91)
CSO32	-0.207*** (-3.09)	-0.388 (-1.62)	0.257*** (3.59)
CSO33	-0.282** (-2.55)	-0.222 (-0.79)	0.289** (2.10)
CSO34	-0.093 (-1.35)	-0.303 (-1.24)	0.316*** (4.28)
CSO35	-0.110 (-1.46)	-0.356 (-1.39)	0.325*** (4.01)
CSO36	-0.020 (-0.24)	-0.433 (-1.56)	0.323*** (3.37)
CSO37	-0.076 (-0.97)	-0.255 (-0.97)	0.430*** (4.61)
CSO41	-0.293*** (-4.28)	-0.533** (-1.99)	0.047 (0.63)
CSO42	-0.276*** (-3.95)	-0.181 (-0.74)	0.159*** (2.09)
CSO43	-0.092 (-1.24)	-0.353 (-1.23)	0.300*** (4.08)
CSO44	-0.131 (-0.96)	_	-0.223*** (-2.50)
CSO45	-0.150** (-2.03)	-0.577* (-1.82)	0.057*** (0.76)
CSO46	-0.172** (-2.36)	-0.153 (-0.54)	0.281*** (3.69)
CSO47	-0.094 (-1.38)	-0.198 (-0.80)	0.376*** (4.92)
CSO48	-0.087 (-1.24)	-0.313 (-1.20)	0.325*** (4.30)
Adjusted R^2 on OLS equation	0.9048	0.9712	0.8876
Function converged at iteration	19	54	30

Thus, the complete model is the following:

$$\ln TC = \alpha_0 + \alpha_1 \ln y + \alpha_2 (\ln y)^2 + \beta_1 \ln p_K + \beta_2 \ln p_L + \tfrac{1}{2}\,\delta_1 (\ln p_K)^2 + \tfrac{1}{2}\,\delta_2 (\ln p_L)^2 + \delta_3 (\ln p_L)(\ln p_K) + \gamma_1 (\ln y)(\ln p_K) + \gamma_2 (\ln y)(\ln p_L) + \Sigma \mathrm{CSO} + \varepsilon$$

$$S = \mathrm{d} \ln TC / \mathrm{d} \ln p_K = \beta_1 + \delta_1 \ln p_K + \gamma_1 \ln y + \eta$$

where TC total cost, y turnover, p_L price of labor, p_K price of physical capital, $\mathrm{CSO_i}$ with $\mathrm{i} \in \{21\text{–}26, 31\text{–}37, 41\text{–}48\}$ dummy variables for the industry codes, S labor cost share[3], η error term (η independent from ε).

Our sample is composed of companies from various industries. To take this heterogeneity into account in the estimation of the efficiency frontier, we include dummy variables for the industry according to the two-digit CSO code. Due to the insufficient number of observations, we cancel some CSO. Table 2 reports the results for the ITSUR estimation of the cost function estimated jointly with the share equation. Based upon the individual t-statistics and the value of the adjusted R^2 statistic on the OLS equation, the fit of the equation is good. As abovementioned, some CSO sectors were deleted from the analysis, because of the insufficient number of observations. In table 3, we present main descriptive statistics for the efficiency scores. Median efficiency scores are relatively similar with a range from 60.73% for Italy to 65.77% for Germany. We also observe very close dispersions of scores with interquartile ranges between 17 and 19 points.

Table 3
Descriptive statistics on efficiency scores
All scores in percentage

	France	Germany	Italy
Number of observations	5295	573	6141
Minimum	9.21	17.08	5.98
Q1	52.71	56.34	50.35
Median	62.34	65.77	60.73
Q3	70.83	73.75	69.38
Maximum	88.76	85.85	86.97

[3] S is equal to the personnel expenses divided by total cost.

5. Results

We perform here a regression to analyze the link between leverage and corporate performance measured by efficiency score. The explained variable is the cost efficiency score in percentage. The main explanatory variable is the financial leverage. We also include in the regression a couple of control variables that were presented in section 3.

The empirical results of the regression are shown in table 4. Based upon the individual t-statistics and the value of the R^2 statistic, the fit of the equations appears to be good with adjusted R^2 ranging from 0.4209 for Germany to 0.6822 for Italy. Collinearity tests show satisfactory results. The main conclusion is the evidence of differences across countries on the sign of the relationship between leverage and efficiency. Indeed the coefficient of the LEVERAGE variable is significant at the 1% level in all three countries, but positive in France and Germany, while negative in Italy. These diverging results can be relied to the different conclusions observed in former single-country empirical studies. Our conclusion then suggests the influence of institutional factors on the link leverage-performance.

Which institutional factors can influence this relationship? According to the arguments of La Porta et al. [1998], the legal and financial systems may influence the external finance and therefore the structure of financing, we consider here four main institutional characteristics. The first institutional characteristic is the access to banks by firms. All countries of the study have bank-oriented systems according to the classification of Demirgüc-Kunt and Levine [2000], consequently the orientation of the financial system can not explain the divergence in results. However they diverge in terms of access to bank credit. Indeed, when measuring the access to banks by firms by the ratio of domestic assets of deposit banks to GDP as Demirgüc-Kunt and Maksimovic [1999], we clearly observe a lower access to banks in Italy than in France and Germany where there are similar values.

The link between this institutional aspect and the relationship leverage-performance is based on the following argument: a lower access to bank credit reduces the possibilities for firms to use banking indebtedness as a signalling instrument. Consequently, the restricted access to bank credit in Italy can lead to a lower possibility of managers with “good-quality” projects to use the debt as a

signalling instrument. As a result, the "signalling argument" suggesting a positive relationship between leverage and performance plays a lower role in Italy than in France and Germany. This institutional factor can then help to explain why Italy has a negative sign, while France and Germany have a positive one.

The second institutional characteristic concerns the protection of shareholders rights. We use here the index developed by La Porta et al. [1998] to proxy this aspect: according to this, shareholders have a better protection in France than in Germany, and are also better protected in Germany than in Italy. The protection of shareholders may indeed influence the link leverage-performance, as well-protected shareholders have less fear of managers'behavior. Consequently the 'free cash-flow argument' resulting from the conflict of interest between shareholders and managers plays a lesser role. Our results however do not corroborate this argument, as there is a positive link leverage-performance in both countries where shareholders are the best protected. Consequently, the protection of shareholders rights does not offer an explaining key for the diverging results about the link leverage-performance.

The third institutional characteristic concerns the protection of creditors rights. We use again here an index developed by La Porta et al. [1998] to proxy this aspect: it shows that the hierarchy of protection is, in decreasing order, Germany, Italy and France. The influence of the protection of creditors rights on the link leverage-performance relies on the moral hazard issues coming from the conflicts of interest between shareholders and creditors. Better-protected creditors have more powers in face of shareholders than can help them to reduce moral hazard problems. Therefore the negative influence of leverage on performance, resulting from the divergence of interests between shareholders and creditors should be lower in countries with the better protection of creditors. However we do not observe this, as France has a lower protection of creditors than Italy while Italy is the only country of the study in which a negative link between leverage and performance was observed.

Finally, a fourth institutional characteristic, also defining the legal system, is the efficiency of the legal system. We adopt here the index from the International Country Risk Guide, used by Demirgüc-Kunt and Maksimovic [1999]: by decreasing order, the more efficient legal systems are those from Germany, France and Italy. The influence of this characteristic on our main question is based on the fact that an efficient legal system may reduce the moral hazard problems, as the rules for the protection of creditors rights are more effective. Consequently, the negative influence

of leverage on performance should be lower where the efficiency of the legal system is the better. Indeed, this explanation can be advanced to explain our results, as the country with the less efficient legal system, Italy, is the only one in our study to have a negative sign for the relationship between leverage and performance.

To sum it up, it appears from our analysis of the institutional characteristics and their influence on the link leverage-performance that two factors, the access to banks for firms and the efficiency of the legal system, can explain the diverging results of the sign of the leverage in our regressions. Indeed the access to banks may reduce the "signalling argument", that supports a positive link between leverage and corporate performance, while the efficiency of the legal system is able to exert a diminution of the moral hazard problems that favor a negative link on this issue.

Regarding the other control variables, we observe quite similar results. The main difference between countries concerns the weaker significativity of the variables for Germany, which seems to be the result of the lower number of observations in the German sample, in comparison to other national samples. TANGIBILITY is negative and significant for all countries. This result can be the consequence of the industry-specific influences: indeed firms from industries with the lower tangibility ratios can be on average more efficient. An alternative explanation based on the treasury management can however be suggested: a higher tangibility of assets means a lower working capital and consequently a lower treasury. Consequently, if we consider that treasury management reflects the managerial ability to lead a company, it can then be argued that tangibility of assets should be negatively linked to managerial performance.

INVENTORY is also negative and significant for France and Italy, while it is not significant for Germany, maybe for sample size reasons as abovementioned. Results are reciprocal for the SHORT-TERM LIABILITIES with a positive and significant coefficient for France and Italy, but not significant for Germany. These results can also be explained in terms of industry-specific influences. Finally, SIZE presents exactly the same results than the latter variable. Apart from the industry explanation, this link can come from the existence of scale economies in some manufacturing industries. It may also be the consequence of the better ability of large firms to attract the best managers, as they offer greater advantages such as higher wages or simply prestige.

Table 4: Regression results
(i) The explained variable is the cost efficiency score in percentage, (ii) LEVERAGE ratio of total liabilities to total assets, TANGIBILITY ratio of fixed assets to total assets, INVENTORY share of inventories in total assets, SHORT-TERM LIABILITIES, ratio of short-term liabilities to total liabilities, SIZE total turnover, (iii) *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level.

	France	Germany	Italy
Intercept	0.675***	0.750***	0.724***
	(71.82)	(33.34)	(91.23)
LEVERAGE	0.048***	0.080***	-0.021***
	(7.92)	(3.49)	(-3.28)
TANGIBILITY	-0.550***	-0.408***	-0.686***
	(-66.60)	(-16.08)	(-92.56)
SHORT-TERM LIABILITIES	0.087***	-0.002	0.142***
	(11.44)	(-0.10)	(20.43)
INVENTORY	-0.040***	0.052	-0.097***
	(-4.05)	(1.34)	(-11.58)
SIZE	2.339^{E}-8***	1.398^{E}-9	3.087^{E}-8***
	(10.22)	(1.18)	(9.94)
Adjusted R^2	0.5611	0.4209	0.6822

6. Concluding remarks

The research presented here has provided new evidence on the relationship between leverage and corporate performance. We use frontier efficiency scores to measure performance to evaluate this issue in France, Germany, Italy. We observe that leverage is positively linked to corporate performance in France and Germany, but negatively relied in Italy. These different results tend to support the impact of the institutional framework on this relationship. Our analysis of the possible impact of the institutional characteristics suggests that two factors may exert an influence: the access to banks for firms and the efficiency of the legal system. In normative terms, our results then support different implications according to the institutional framework of the country: the policies promoting equity should only be favored in Italy, as this is the only country of our study where leverage is negatively linked to performance.

Our results should however be considered with care as this issue needs further analysis to evaluate the importance of each theoretical argument in connection with

the institutional characteristics. The empirical analysis should thus be extended to a larger number of countries. In this area, it should also be proceeded to Granger-causality tests to analyze the causality between leverage and corporate performance to evaluate the informative power of each theory on the link leverage-performance. However this would require data on a long period to have enough panel data to perform this analysis, which was not available for this study.

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APPENDIX

Table A
Sample breakdown for industries

	France	Germany	Italy
CSO 21 (extraction and preparation of metalliferous ores)	_	_	4
CSO 22 (metal manufacturing)	132	20	196
CSO 23 (extraction of other minerals)	56	4	23
CSO 24 (manufacture of non-metallic mineral products)	241	34	347
CSO 25 (chemical industry)	546	82	439
CSO 26 (production of man-made fibres)	9	3	13
CSO 31 (manufacture of metal goods)	447	47	544
CSO 32 (mechanical engineering)	702	119	1051
CSO 33 (manufacture of office machinery and data processing))	35	13	21
CSO 34 (electrical and electronic processing)	437	55	477
CSO 35 (manufacture of motor vehicles and parts)	170	30	177
CSO 36 (manufacture of other transport equipment)	84	19	71
CSO 37 (instrument engineering)	124	18	78
CSO 41 (food, drink and tobacco manufacturing industries: part 1)	484	18	454
CSO 42 (food, drink and tobacco manufacturing industries: part 2)	347	47	314
CSO 43 (textile industries)	198	10	524
CSO 44 (manufacture of leather and leather goods)	18	_	96
CSO 45 (footwear and clothing industries)	201	6	371
CSO 46 (timber and wooden furniture industries)	223	11	305
CSO 47 (manufacture of paper and paper products)	494	39	299
CSO 48 (processing of rubber and plastics)	344	21	331
CSO 49 (other manufacturing industries)	66	6	61

All cases represent the number of observations.