International Proceedings of Economics Development and Research
IPEDR vol.85 (2015) © (2015) IACSIT Press, Singapore

Relation between EVA® and Capital Structure in the Worldwide Steel Mill Industry in Economic Crises: A Study from 2006 to 2011

Johan Hendrik Poker[+], Victor Maschietto Murakami and Márcio Marcelo Belli

Faculdade de Ciências Aplicadas (FCA), UNICAMP, Brazil

Abstract. Purpose – This paper aims to test whether the economic value added (EVA®) was a determinant of the changes in the capital structure in the worldwide steel mill sector during economic crises. Design/methodology/approach – The long-term effect of changes in capital structure on firm value is examined, using a sample of 361 steel mill companies during the period from 2006-2011. Findings – The null hypothesis was rejected. Evidence is found to support a significant relationship between the changes in economic value added (EVA®) and the changes in debt ratios. To assess the strength of this finding, control variables were taken into account. Similar results were obtained. Originality/value – This paper is one of the first ones to analyze the relationship between economic value added and financial structure changes during economic crises with a focus on steel mill industry.

Keywords: Financing, Capital structure, Economic Value Added (EVA®), Economic Crisis

1. Introduction

Despite the significant evolution of economic anticontagion mechanisms, the effect of crises and political and economic instabilities on the performance of organizations in more traditional sectors of activity can be widely felt. Government policies and corporate strategies have been proposed to reduce the impact of economic crises on organizational activities. Economic crises are perceived by organizations in many ways, but particularly by the effect on the economic performance and the risks involved in its capital structure.

In this study, a dynamic panel data was developed, considering the link between the following elements: the economic performance, represented by the economic value added (EVA®) and the capital structure of the organization. The sample used consisted of 361 worldwide steel companies listed on the stock exchange market, corresponding to an extension of the study by [1] for this same industrial sector, strictly limited for Brazilians companies.

On one hand, the return on capital of a company is one of the main concerns of the management staff of a company in economic crises. On the other hand, it is an element in relation to which the management of the organization has little capacity to act in times of crises. In addition, the capital structure of the organizations is one of the many variables that are influenced by executive decisions. Thus, company executives might be able to create strategies to minimize the effects of economic oscillations over the costs of capital and the risk of default of the organization.

Knowing that the cost of capital is determined by the capital structure of the organization and that the economic value "measures the difference, in monetary terms, between the return on capital of a company and the cost of this capital" [2], the result is a dynamic integration between these elements.

Therefore, the study by the method of dynamic panel data allowed the identification of interrelations and the temporal effects of decisions on the capital structure of the organization. It was possible to contribute with quantitative subsidies for the decision-making process of organizations in the steel mill sector, to

[+] Corresponding author. Tel.: +19 33816076
E-mail address: johan.poker@fca.unicamp.br

contextualize them about the alternatives of leverage so that they can be adopted in times of economic crisis, preserving and maximizing the generation of economic value without incurring in a capital structure that would expose the organization to risky conditions.

For the creation of economic value, as shown, it is mandatory that the companies obtain higher returns to all costs, including the cost of equity, which is not considered by traditional performance measurements. In other words, the management staff aims to get the investment that generates the highest return with the lowest financing cost, thus alternating the capital structure, which is, the combination of debt and equity capital.

From the moment that the initial proposition of irrelevance of capital structure for the cost of capital was presented by [3], several authors considered the restrictions presented in the initial proposal, evolving the theory for what is conventionally called the trade-off hypothesis, in this proposition, it would be possible to find an optimal level of debt that minimizes the cost of capital (and thus maximizes the economic profit).

In contrast to this theory, there is a hypothesis known as the pecking order (order of priority), by Myers [4], in which the capital cost minimizer would be determined by the prioritization of different payment sources, dynamically, considering the market conditions and offerings, but also the projects and demands of the capital of the organization.

Although today there is not a definition about the adoption of different theories, it is possible to identify the elements of both theories in several empirical studies already performed. To study the interrelation between EVA® and the capital structure is to delve into the same study prospects. This means to state a set of control variables to take the different theoretical frameworks into account.

The results revealed a negative relationship between the economic values of previous years and the present indebtedness of the organization. This result presents elements consistent with the pecking order theory, once the economic profit perceived by the organization can be expressed as excessive cash, which, due to the low cost of funding and default risk reduction, was prioritized by the organizations in the sample.

When analyzing the companies grouped in economical blocks, a peculiarity of the results was the behavior of the US and Canada group. This group differs from other groups that increased their indebtedness during the crisis, making use of the available emergency funding. However, in the following year, it resumed the practice of prioritizing funding with equity, as evidenced by the preservation of the signal in the sample snip.

2. Literature Review

2.1. Capital structure

One of the most important decisions that companies must make is regarding their capital structure. According to [5], "The financing structure determines how the value of the company is allocated". As previously mentioned, Modigliani and Miller (MM) conducted important studies on capital structure. As stated by Brigham et. al. in [6], p.603:

> *"Until 1958, the theory of capital structure was consisted of scattered statements about investor behavior rather than carefully constructed models that could be tested by formal statistical analysis. In what has been called the most influential set of financial documents already published, Franco Modigliani and Miller (MM) approached the capital structure of rigorous and scientific way and established a chain of research that continues to the present day."*

MM initiated the modern theory of capital structure in 1958, proving that the value of a company does not change according to its capital structure, but based on very strict assumptions, as the absence of taxes and bankruptcy costs.

The inclusion of taxes in the analysis is important, it brings the benefits of tax saving, favoring the financial leverage and encouraging firms to use debt. The fact that the interest is deductible makes the debt less expensive if compared to other types of financing.

Under the assumptions of MM considering company taxes [7], the higher the debt used by the company, the higher would be its value and stock prices. In other words, the price of its stock would be maximum if it

used only debt as its capital structure. Brigham et. al. on p.574 [6] summarize: "The returns of the common stock are taxed at significantly lower effective rates than debt returns." It is important to highlight that this is related to long-term debt.

However, in the real world using 100% debt is impossible. The reason for that is to avoid financial difficulties, the risk of bankruptcy. Not to mention that, at high levels of indebtedness, the interest rate becomes higher and the demand for stock returns increases, ceasing to be an advantageous strategy.

The Trade-off Theory consists in optimize the cost of capital based on tax benefit of debt and risk of bankruptcy costs. In other words, a company increases its debt until the marginal tax benefit of debt is offset by the amount of financing costs. The Trade-off seeks to maximize the benefits and minimize the costs of debt, finding an optimal capital structure for that.

For its part, the Pecking Order Theory establishes a dynamic vision of the financing process, considering the effects of taxes, bankruptcy costs, financial tensions and problems of agency and signaling (Myers, 1984). This theory surmises the concepts of cost of agency asserted by Jensen and Meckling [8] and signaling framework proposed by Ross [9]. The management staff can take advantage of asymmetric information to pick the less expensive financing alternatives. The Pecking Order suggests an explanation for why, in adverse conditions, the most profitable companies do require fewer loans and less profitable companies tend to appeal more frequently to the issuance of debt. The idea is that the first can use internal funds to finance their investment plans in times of need.

The Pecking Order Theory suggests that managers create a hierarchy of funding options according to the internal and external conditions at the time of the decision. This hierarchy usually corresponds to: internal resources, risk-free securities, risk securities and lastly launch of new shares. This is an attempt to reduce costs created by information asymmetry and signaling in markets where financing demands are high and market imperfection increases the information asymmetry.

2.2. Economic value added (EVA®)

Measuring performance is a matter of great controversy. Each metric serves for a different purpose, and each activity requires different conceptualizations, so, it is necessary to find methods to develop general measurements of the value creation for organizations that satisfy the needs of all different stakeholders.

Various methods have been proposed, however, EVA®, as stated by its authors [2], has shown an increasing role in the decision-making process of stakeholders of organizations, as more companies adopt it for evaluation purposes. For these companies, the preference for EVA® is based on a simple idea: it communicates the performance of the company more directly, from the perspective of value for shareholder, than the earnings per share (EPS) or net profit. Furthermore, since EVA® can be used in the divisional levels, it allows companies to develop internal measurement programs for performance, programs which are more aligned with the factors that ultimately drive the value in the capital markets. Kassai [10] contributes by saying: "By representing the economic outcome after remuneration of all financing agents, EVA® represents the creation (or destruction) of the wealth of the enterprise as a whole."

The corollary of EVA® is brought by Brigham et. al. on p.369 [6]:

> *"Companies are actually profitable and create value only if their profits exceed the cost of all the capital they use to fund operations. The conventional measure of performance, the net profit, considers the cost of debt, which appears in the financial statements as interest expense, but does not reflect the cost of equity. Therefore, a company may report a positive net income, but still not be profitable in the economic sense if your net profits are lower than its cost of equity. The EVA® corrects this flaw to recognize that to properly measure the performance of a company is necessary to consider the cost of equity."*

What makes EVA® a sound option to measure corporate performance is that it reduces to a single number the operating and financial performance of the company, by taking into account the cost of all sources of capital a company has used to generate the income [11]. EVA® brings the notion of economic profit, which starts from the premise that wealth is only created when the company outperforms all costs,

both operational and capital. Moreover, EVA® contributes to the idea of value, beyond a measure of performance, being a central reference of a process of implementing strategies.

According to Brigham et al. on p. 64 [6]:

> *"The EVA® is an estimate of true economic profit of the company for the year, and very different from accounting profit. The EVA represents the residual income that remains after the cost of all capital, including equity that has been deducted, while the net income is determined without putting a burden for the equity. "*

According to [12], who named the EVA® as economic profit, using the definition of its origin in economic studies performed by Marshall, this measures the economic value created by a company in one year, and is defined according to equation (1).

$$EVA® = \text{Invested Capital x (ROIC} - \text{WACC)} \quad (1)$$

Where:

EVA®= Economic Value Added

Invested Capital= Investment value at the beginning of the year

ROIC= Return on invested capital

WACC= Weighted average cost of capital

The capital investment is measured at the beginning of the year to make it compatible with the discounted cash flow method.

3. Methodology

As previously mentioned, this study is a quantitative research. The research variables were EVA®, as an independent variable, and corporate debt (calculated as the ratio of total debt and total equity) as a dependent variable. The following variables were considered as intervening variables: firm size, dividend policy, company performance risk and collateral risk. The technique used for the analysis was the regression with dynamic panel data [13].

The 361 selected companies belong to the steel mill sector from seven geographic regions; the data were collected during the period from 2006 to 2011. They were selected using the following criteria: (1) public companies and (2) primary industry classification as steel mill companies, (3) with observations throughout the historical period that allowed the calculation of the operating variables.

3.1. Research variables

The variables were divided into research and control variables. The research variables were EVA® (independent variable) and Debt Level (dependent variable), of each company into the sample, calculated for annual periods from 2006 to 2011.

EVA® was calculated from the annual financial statements and the cost of capital in relation to the studied period. The database of S&P Capital IQ was the source for the financial statements.

To calculate the cost of capital (WACC), equation (2) was considered:

$$WACC=Wd*Rd(1-T)+We*Re \quad (2)$$

Where:

WACC= Weighted Average Cost of Capital

Wd= Weight of Debt (percentage of financing that is debt)

We= Weight of Equity (percentage of financing that is equity)

Rd= Cost of Debt

Re= Cost of Equity

T= Tax Rate

Initially, the cost of equity (Re) was established by the CAPM formula, which, in this case, was considered as equation (3):

CAPM= Risk Free Rate + (Beta * Market Risk Premium) + Country Risk Premium (3)

For the risk free rate (Rf), the *U.S. Treasury Bonds 10 Year Yield* was considered for the dates analyzed. The beta for companies (steel industry) was based on the compilation of the average sectorial betas reported by Damodaran [14]. The Market Risk Premium was obtained according to the study by Fernández [15]. The Country Risk Premium was determined according to the country of the headquarter of each company and defined according to the data provided by Hunang [16].

The cost of debt of each company (Rd) was established by the Cost of Capital by Sector provided by Damodaran [17].

The remaining indicators, Wd and We, were calculated according to equations (4) and (5).

Wd = Total Debt / (Total Debt + Total Common Equity) (4)

We = Total Common Equity / (Total Debt + Total Common Equity) (5)

In possession of the amounts and the estimated capital costs of equity and debt, the weighted average cost of each firm was calculated in the sample. Through the values of the cost of capital, it was possible to calculate the EVA® of each company as proposed in equation (1). The EVA® was calculated weighted by total assets to prevent distortions caused by differences in size across the companies studied.

3.2. Control variables

As control variables, the following factors were selected: company size, dividends paid, variation of operating income (as a proxy for performance risk) and variation of collateral (as a proxy for financial risk), as shown in Table 1.

Table 1: Control variables description

Variable	Description
Company Size	Logarithm of Total Assets
Dividends Paid	Dividends over Total Assets
Performance Risk	(Net income (CY*) – Net income (CY-1))/Net income (CY-1)
Collateral Risk	(Fixed Assets(CY*) – Fixed Assets (CY-1))/Fixed Assets (CY-1)

*CY – Current Year

4. Analysis of Results

The statistical analysis comprised the use of a dynamic panel regression in 2 steps with time-fixed effects and robust asymptotic standard error. The model was chosen by a test-based selection criteria shown in Table 2, the results imply: the rejection of fixed effect models, but not the time-fixed effects, the need to correct for heteroscedasticity with robust error model, the absence of a unit root and the construction of a model with instruments uncorrelated with the error term.

Table 2: Statistical Tests and Results

Test	P-value	Results
Hausman	0.0007	Rejects fixed effects
Breusch-Pagan	0.0000	Rejects fixed effects
Modified Wald	0.0000	Rejects homoscedasticity
Levin-Lin-Chu	0.0000	Rejects unit root
Sargan	0.1365	Error term uncorrelated with the instruments

The results obtained were based in 1444 observations of 361 steel mill companies globally distributed between 2006 and 2011. The dependent variable was total debt over total assets and the independent variables had the significance as reported in Table 3.

Table 3: Panel data regression parameters and significance

Variable	Coeficient	p-value	Significance
Lag 1 of Debt %	0,5964630000	0,000000	***
constant term	0,0369045000	0,000007	***
Company Size	0,0359953000	0,088600	*
Company Size (CY-1)	-0,0130337000	0,466900	
EVA	-0,0088542600	0,309600	
EVA (lag 1)	-0,0294968000	0,001500	***
Dividend Paid	-0,1340350000	0,014700	**
Dividend Paid (CY-1)	-0,0461121000	0,539000	
Performance Risk	-0,0000013290	0,709500	
Performance Risk (CY-1)	0,0000009480	0,798300	
Collateral Risk	0,0000032319	0,088800	*
Collateral Risk (CY-1)	-0,0000004212	0,774000	
Fixed Time Factor 2008	-0,0780343000	0,000000	***
Fixed Time Factor 2009	-0,0268373000	0,020800	**
Fixed Time Factor 2010	-0,0231530000	0,008000	***

It was observed in Table 2 that, for the control variables, the statistical significance was achieved (at least 10%) for the size of the company (with direct relation to its debt), the amount of dividends paid during the period (in inverse relation to its debt), and the variation of real assets (with direct relation to its debt).

In turn, the research variable was significant (p-value less than 1%), for one year lagged EVA. This result implies an evidence that, during the analyzed period, the steel companies followed the pecking order theory, because the result of the generation of economic value from the previous period was succeeded by the variation in reverse debt in the following period.

In Figure 1, variations can be identified in the difference between ROIC and WACC arising from the crisis in the period studied. It was possible to identify a significant decline in ROIC-WACC in 2009 in most regions. Also, it is possible to notice the variation over the years 2006 to 2011 in the difference between ROIC and WACC. The United States and Canada suffered an atypical variation compared to the others, having in 2010 its greatest difference, 35.19% in relation to the indicators in question, unlike the other regions that reached a maximum of 6.32%, while in Asia and Europe the WACC was greater than the ROIC.

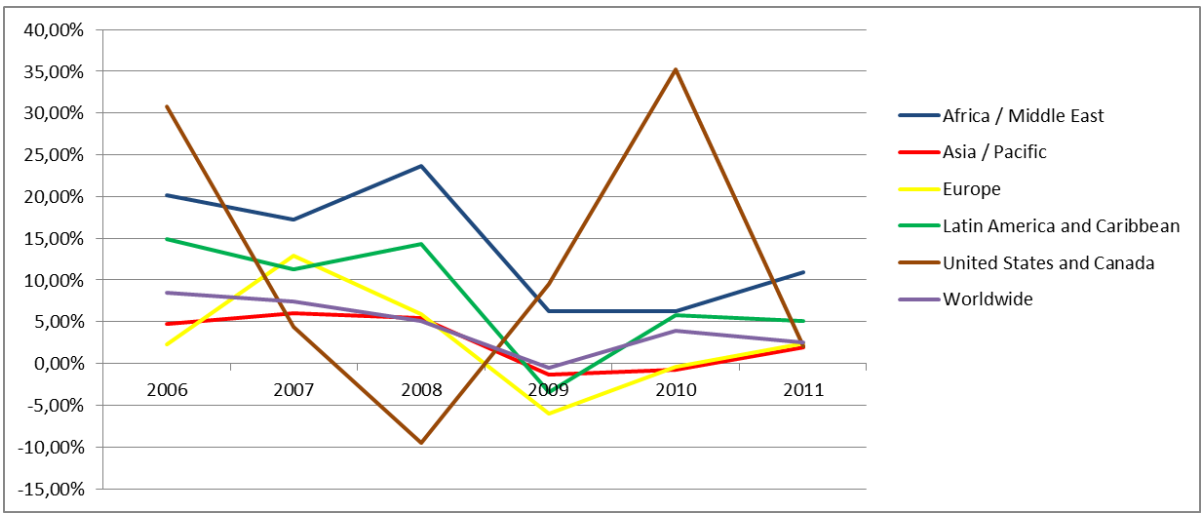

Fig. 1: Average ROIC-WACC by region.

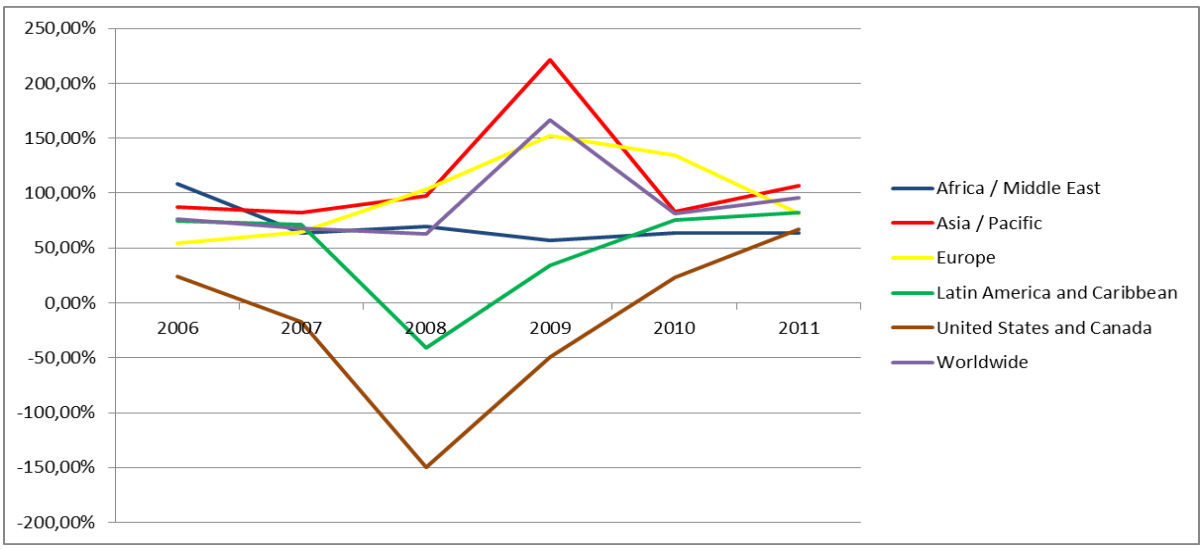

Fig. 2: Variation of intebtness by region.

Figure 2 makes it possible to visualize the variation (current - previous year) of indebtedness, by regions. It is clear that firms in the regions of Asia/Pacific and Europe increased their debt after 2008, the global economic crisis period. Companies in other regions reduced their debt in the same period, rising it again in 2010.

5. Conclusions

This study allowed the analysis of funding decisions taken by the steel companies in the world before and after the economic crisis. In this case, it was found an evidence of the relationship between the economic value added (EVA®) from the previous period and capital structure decisions after.

The evidences found are favourable elements to sustain the Pecking Order theory for steel companies during periods of economic instability. According to this theory, this is the expected relationship for surplus profits versus indebtedness; the generating profits were used in the following year to prioritize cash generation, not seeking the optimal capital structure, but the adequacy of the debt to the macroeconomic condition perceived. The way in which the companies allocated their profits may reflect the global crisis that occurred during the studied period. This condition was verified by the decrease of the difference between ROIC and WACC after 2008 and the stabilization of capital structure only after 2010.

6. References

[1] F. F. C. Perobelli, J. E. A. Cerqueira, G. S. Castro, and R. B. Pazos. Rela ção EVA® Estrutura de Capital: uma

Análise em Painel em Empresas Brasileiras do Setor de Siderurgia e Metalurgia (EVA ® Relationship Capital Structure: A Panel Analysis in Brazilian Companies in the Steel Making and Metalurgy Sector). *ENANPAD*, Rio de Janeiro, 2007.

[2] D. S. Young, and S.F. O'Byrne. *EVA® and Value-Based Management A Practical Guide to Implementation*, Mc Graw-Hill, 2001: 20.

[3] F. Modigliani, and M. Miller. The cost of capital, corporation finance and the theory of investment. *American Economic Review*. 1958, **48** (3): 261-297.

[4] S. Myers. The Capital Structure Puzzle, *Journal of Finance*. 1984, **39** (3): 575-592.

[5] S. A. Ross, R.W. Westerfield, and J. Jaffe. *Corporate Finance, International Edition*, New York, USA: McGraw Hill, 2005: 25.

[6] E. F. Brigham, and M. C. Ehrhardt. *Financial Management: Theory and Practice*. 11th ed. Mason, Ohio: Thomson/South-Western, 2005: 1000.

[7] F. Modigliani, and M. Miller. Corporate income taxes and the cost of capital: A correction. *American Economic Review*. 1963, **53** (3): 433-443.

[8] M. Jensen, and W. Meckling. Theory of the firm: Managerial behavior, agency costs, and ownership structure, *Journal of Financial Economics*. 1976, **3** (4): 305-360.

[9] S. A. Ross. The determination of financial structure: The Incentive-Signalling approach, *Bell Journal of Economics*. 1977, **8**: 23-40.

[10] J. R. Kassai. Conciliação entre o VPL e o EVA®: Abordagem matemática e contábil do Lucro Econômico (Reconciliation of NPV and EVA ®: Math and accounting approach of Economic Profit). *Revista Brasileira de Contabilidade (Journal of Accountancy)*. 2005, **156**: 23-35.

[11] A. Ehrbar. *Economic Value Added: The Real Key to Creating Wealth*. New York, USA: John Wiley & Sons, Inc., 1998: 256.

[12] T. E. Copeland, T. Koller, and J. Murrin. *Valuation: Measuring and Managing the Value of Companies*, 3rd ed., New York, USA: John Wiley & Sons, Inc., 2000: 576.

[13] J. M. Wooldridge. *Introductory Econometrics: A Modern Approach*. Mason, OH: Thomson/South-Western, 2006: 912.

[14] A. Damodaran. *Cost of Capital by Sector*. Retrieved October 24, 2012, from http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/wacc.htm.

[15] P. Fernandez. *Market Risk Premium used in 56 Countries in 2011: A Survey With 6,014 Answers*. Retrieved October 24, 2012, from http://www.iese.edu/research/pdfs/di-0920-e.pdf.

[16] A. Hunang. *Country Risk Premiums*. Retrieved October 24, 2012, from http://www.sjsu.edu/faculty/watkins/countryrisk.htm.

[17] A. Damodaran. *Betas by Sector*. Retrieved October 20, 2012, from http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/Betas.html.