Evaluation issues in cyclical companies: an empirical study on the steel industry (*)

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ABSTRACT: Empirical evidence indicates that the intrinsic values of cyclical companies are much more stable than their market values. As a consequence, market values may not serve as good proxies of the fundamental values of cyclical companies, as market efficiency theories would suggest. This paper aims to investigate whether the pillars of market efficiency theories hold in the context of cyclical companies during cycles' troughs. The analysis centers on the steel industry, which is characterized by strong cyclicality. In particular, the paper focuses on the steel sector's crisis of 2009, when fundamental and market values differed significantly. If market efficiency pillars were found to hold true also during such a period, all the more so they should be considered as true during less critical times, while the detection of market inefficiency – even during a critical period – would be sufficient to challenge market efficiency theories. The analysis was carried out by comparing the market-enterprise values and the fundamental-enterprise values of a sample of mature steel companies as of 2009 by means of non-parametric tests. Fundamental enterprise values were calculated using two normalized fundamental steady state free cash flow to firm models. This approach allowed us to incorporate the cyclical features of steel companies' financial figures in simple models, relying on the single main assumption that future business cycles will resemble the last business cycle. The analysis focused on identifying whether any predictor was useful in describing the difference between market values and fundamental values, and thus in identifying market inefficiencies. The results suggest that the market tends to price cyclical companies in a biased manner during cycles' troughs. More specifically, cyclical companies appear to be undervalued by the market during industry crises. The paper manages to test market efficiency pillars by exploiting few assumptions, and relying on simple models. The simplicity of the models and the limited number of assumptions allowed the analysis to address a sample of companies that show significant differences in terms of geographies and dimensions in a standardized and common manner. In addition, the work highlights how normalized fundamental valuation can be adapted to cyclical companies belonging to different geographies and thus to markets showing different historical trends.

1. Introduction

An intense debate concerning market efficiency has been ongoing in global financial and economic research for decades. On the one hand, market efficiency theories suggest that companies' market values are unbiased proxies of their fundamental values (Fama, 1970). On the other hand, behavioral finance research shows that markets are often driven by investors' sentiments and that, for this reason, market prices may not be good estimates of fundamental values (Shiller, 1984).

The empirical evidence suggests that, in some cases, companies' intrinsic values are much more stable than their market values (Koller et al., 2010). The most relevant ex-

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(*) Articolo sottoposto a doppio referaggio anonimo.

amples are cyclical companies, as their earnings are more influenced by certain macroeconomic variables than by any firm-specific event (Damodaran, 2009; Koller et al., 2010). As a consequence, market prices may not be unbiased estimates of the fundamental values of cyclical companies, as market efficiency theories imply. Therefore, this paper aims to verify whether cyclical companies' market values are good estimates of their fundamental values.

In analyzing this issue, this paper centers on the steel industry, which is characterized by strong cyclicality (Damodaran, 2009; De Heer et al., 2000; Koller et al., 2010). The steel industry has undergone significant expansion in the past ten years, as well as a major crisis (Worldsteel Association, 2012). The 2009 contraction serves as an interesting focal period, as the cyclicality of the steel industry was pronounced at that time.

This paper is structured as follows. First, the relevant literature concerning market efficiency and behavioral finance is described, as is the possible existence of a difference between a company's market and fundamental values. The focus then shifts towards techniques useful for identifying the fundamental value of a cyclical company. The literature review ends with the development of the hypothesis. In the subsequent section, the methodology used to perform the empirical analysis is depicted. The models chosen for the fundamental valuation are described, and the comparison of the fundamental and market values is presented in detail. The results are then discussed. The final section provides an overview of the theoretical and managerial implications of the findings presented here, together with some suggestions for future research.

2. Literature review and hipothesis development

2.1. Market Efficiency

An efficient market is "a market in which prices always fully reflect available information" (Fama, 1970, p. 383). As prices are set through trading, a market can be efficient only if financial players have access to all of the relevant information and exploit it to pick stocks that will maximize their risk-return. More precisely, in an efficient market, investors are rational. Rational investors are able to quickly—instantaneously, from a theoretical perspective—detect and exploit every potential arbitrage opportunity stemming from any piece of news. This drives prices towards equilibrium and eliminates arbitrage possibilities. As a direct consequence, prices in efficient markets incorporate all available information (Fama, 1965).[1]

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[1] The extent to which information is reflected in market prices has been described in terms of three levels of intensity: weak form, semi-strong form, and strong form (Fama, 1970). In the weak form, market prices only reflect historical information. In the semi-strong form, market prices reflect not only historical information but also any information that becomes publicly available. The strong form of market efficiency requires that both public and private information be incorporated into market prices. Moreover, in the quasi-strong form, professional investors who sometimes have access to information that is not publicly available cannot generate higher profits than those that one could obtain by randomly selecting stocks with similar risk profiles. In the super-strong form, even if a company insider, such as the CEO, tries to exploit some confidential information, he cannot outperform the other market players.

However, in order to incorporate all relevant information, all "sufficient conditions for capital market efficiency" must be present (Fama, 1970, p. 387). These conditions include the absence of transaction costs and the availability of all information to all market players at no cost. In addition, all market players must share the same views on the implications of information for current and future market prices. No existing market can fully comply with these conditions—transaction costs are a common feature of financial markets, information sources are seldom open to all market participants, and views on stock prices and estimates usually differ. However, these conditions are only "sufficient" for market efficiency. As long as transaction costs do not block all transactions, a "sufficient number of investors" have access to all relevant information, and no market player is able to consistently gain better returns than others on the basis of his or her views, markets can still be considered efficient (Fama, 1970).

In an efficient market, the price of a stock is "a good estimate of its intrinsic value" (Fama, 1965, p. 56), such that any deviation in the stock price from its intrinsic value must be random. In other words, the market prices of all stocks are unbiased estimates of their fundamental values. Indeed, as any relevant news is assumed to be immediately (or, at least, very quickly) reflected in stock prices, and as news is by definition unpredictable, price shifts (and therefore temporary detachments of market prices from intrinsic values) must be random according to the market efficiency framework (Malkiel, 2003). Therefore, it is equally likely that stocks will be overvalued or undervalued. Furthermore, no observable variable (e.g., firm, sector, or geographical features) are assumed to be correlated with deviations between fundamental and market values (Damodaran, 2001).

Tests of market efficiency are extensively discussed in the literature (see, inter alia, Fama, 1970; Jensen, 1967; Haugen and Lakonishok, 1987; Malkiel, 2003; Roll, 1983). One of the most studied variables with respect to the production of biases in market prices is the price-earnings (P/E) ratio (Basu, 1977; Graham, 1949).

In the context of cyclical companies, P/E ratios seem to show countercyclical behavior, as they are high at the bottom of business cycles and low at the top of those cycles (Molodovsky, 1953). Hence, researchers have inferred that markets are efficient in pricing cyclical companies and that they correctly incorporate the financial performance of those companies in unbiased market-price estimates (Damodaran, 2009). This "compensating principle" (Molodovsky, 1953, p. 33), rests on the definition of the value of a company as its discounted future earnings, for which the best proxy (the "earnings power") is the market estimate of a company's average future earnings based on past experience and current data. When current earnings are below the earnings power, P/E ratios will be high because the market recognizes that earnings will be higher in future years. According to the same principle, low P/E ratios will emerge when current earnings are higher than companies' earning power (Molodovsky, 1953).

2.2. Behavioral Finance

Over the last thirty years, a significant amount of research has focused on establishing the soundness of the market efficiency framework and empirically verifying that framework. These studies have given rise to behavioral finance theories. Such studies not only highlight anomalous market phenomena that are incompatible with market efficiency, but also try to explain those phenomena through the combined exploitation of

psychological, sociological, and financial arguments (Shiller, 2003). The main point raised in behavioral finance research is that stock prices are not exclusively influenced by news on fundamentals—they are also affected by investor "sentiment" (Shiller, 1984).

One of the most striking proofs of the psychological component in financial markets is an empirical study conducted on a sample of investors after the market crash of October 1987. Most of the people interviewed in that study stated that they did not believe that any change in fundamentals had occurred before the market crash. Rather, they reported that there was a great deal of anxiety as well as a contagion of fear among investors in the days preceding the market crash, and that the panic bubble literally burst on the day of the crash (Shiller, 1987). The interviewees reported physical symptoms, including difficulty concentrating, sweaty palms, tightness in the chest, irritability, and a rapid pulse. Notably, many companies' insiders went long on their companies' stocks after 1987, thereby profiting from the undervaluation created by the panic (Seyhun, 1990).

However, behavioral finance theories do not only concern market bubbles or crashes. They also extend to ordinary activities in the market. Along these lines, related areas of study are "limits to arbitrage" and "psychology" (Barberis and Thaler, 2003).

Studies focused on limits to arbitrage show that, even in normal periods, the proportion of non-fully-rational players (often labelled "noise traders") is big enough to prevent rational players from restoring equilibrium through arbitrage because of resource and information constraints. Therefore, as rational investors cannot profit from the wrong choices made by noise traders, they sometimes have an incentive to align their trades with those of noise traders, thereby amplifying biases in stock markets (Shleifer and Summers, 1990). For these reasons, misalignments between market prices and fundamentals may not be erased through the immediate exploitation of arbitrage opportunities (Krugman, 2009), as suggested by supporters of market efficiency theories. On the contrary, irrationality can have a substantial and long-lived impact on prices (Barberis and Thaler, 2003).

The psychological area of behavioral finance analyzes how irrational players make their choices and incorporate irrational mechanisms into financial modeling. The pillars of these studies are analyses of the "beliefs" and "preferences" of market players (Barberis and Thaler, 2003). Studies of market players' beliefs investigate expectations for financial developments, and investors have often been found to be "overconfident" and "anchored" to their estimates (Alpert and Raiffa, 1982; Fischoff et al., 1977; Kahnemann and Tversky, 1974). Studies concerning preferences focus on the empirical verification and theoretical explanation of deviations from expected utility theory (Von Neumann and Morgenstern, 1944) in market actors' decision making in risky contexts. These studies, which are labelled "prospect theory", suggest that investors are driven more by the amount they could gain or lose in a gamble than by the change in their overall wealth that could result from the gamble. They also show that the small probabilities associated with big gains are sometimes preferred to the higher probabilities associated with smaller gains (Kahnemann and Tversky, 1979).

2.3. Behavioral Corporate Finance

Research has found that in addition to traders and asset managers, managers and research analysts may be biased in their behaviors. The study of the latters' behaviors,

which is the focus of behavioral corporate finance, can be divided into three areas. The first assumes that irrational investors can cause stocks' mispricings and focuses on the ways in which managers can profit from those mispricings. The second area stresses that managers can act irrationally and make sub-optimal decisions (Barberis and Thaler, 2003). The third area focuses on biases in analysts' estimates.

As behavioral finance studies show that market investors can be irrational, the first area of study acknowledges that companies' market prices can differ from their intrinsic values. In this context, "smart managers" are able to recognize mispricings are able to exploit the irrationality of market players with the aim of creating value for their companies (Barberis and Thaler, 2003). For example, when smart managers realize that their companies' stocks are overvalued, they attempt to finance operations or expansion projects by issuing new shares, while they undertake stock buybacks when companies are undervalued (Stein, 1996). The effectiveness of this managerial approach, which is known as "market timing", is supported by strong empirical evidence. In fact, long-term returns following IPOs or seasoned offerings appear to be low (Loughran and Ritter, 1995), while long-term returns are usually high after stock repurchases (Ikenberry et al., 1995). Hence, smart managers appear to be able to correctly exploit their companies' overvaluations or undervaluations, thus maximizing value creation. On the other hand, "behavioral signaling" is based on the idea that smart managers act rationally and pay close attention to investors' sentiment when they, for instance, publicly announce investments in research and development, joint ventures, product strategies, or capital expenditure. The empirical evidence suggests that markets positively react to these announcements on the day of the announcement itself and for an ensuing period of days or even months (Chan et al. 1990). Smart managers also recognize that the market overreacts to dividend cuts. Hence, even though a dividend increase has a positive impact on share value, it may not be a good strategic choice from a medium- to long-term perspective if the new dividend will be unsustainable, such that a cut will become necessary (Aharony and Swary, 1980). The behavioral signaling literature goes as far as to study how a change in a company's name that leads stakeholders to recall fashionable products or trends can positively impact share prices (Cooper et al., 2001). It therefore offers another relevant argument against market efficiency theories.

The second area of studies states that irrational players can be found among both investors and managers. Irrationality in managerial behavior is best described in studies of takeover activity, where the overall value creation stemming from acquisitions appears to be close to zero (Roll, 1986). This finding can be explained in light of the "Hubris Hypothesis", which suggests that managers are overconfident in their analyses of external growth opportunities (Roll, 1986). More specifically, managers typically rely strictly on their own expectations for synergy creation, which is often a risky tactic in terms of possible negative outcomes (Roll, 1986). In addition, ordinary managerial activities, such as the financing of operations or the pursuit of profitable investment opportunities, may be subject to the irrational behavior of managers. Indeed, empirical evidence shows that managers sometimes stick to the belief that their company is undervalued, which leads them to exploit all of their companies' internal financial resources and all debt-raising opportunities before deciding to launch an equity issue (Heaton, 2002). As a consequence, they leave their companies unable to exploit investment opportunities.

Third, although analysts' estimates serve a "descriptive function" by helping investors understand the behavior of the stock market, they also have a "prescriptive function" in the sense that they are key tools for estimating future performances (Olsen, 1996). Despite being widely used, analysts' estimates have been found to often be biased and are therefore a potential source of market inefficiency. However, there is no clear consensus on why analysts' estimates might be biased or on whether the bias is most likely to be positive or negative (Damodaran, 2001). Analysts often appear to have incentives to provide optimistic earnings estimates when their employer has important relationships with the reviewed company. Alternatively, they could have an incentive to make positive forecasts because the company in question could label pessimistic reviews as "adverse reporting" and, consequently, cut the analyst off (Clayman and Schwartz, 1994; Francis and Philbrick, 1993). Moreover, bias in analysts' earnings forecasts can reside in "herding behavior … [the] tendency of forecasters to 'shade' or move their published earnings forecasts toward those of their colleagues" (Olsen, 1996, p. 37). Extant research demonstrates that the more difficult a forecasting task is, the more likely herding becomes among analysts (Blake and Helson, 1957; Crutchfield, 1955). The phenomenon is therefore common in forecasts concerning cyclical companies, as their financial figures show high variability and are difficult to predict (De Heer et al., 2000). Furthermore, some authors claim that analysts' earnings estimates are negatively biased in cycles' troughs and positively biased in cycles' peaks, as "forecasters suffer from a systematic tendency to underestimate change" (De Heer et al., 2000, p. 2). Other scholars, who find that herding usually produces optimistic estimates, claim that "more optimistic forecasts are usually better for the investment business than less optimistic forecasts" (Olsen, 1996, p. 38). In other words, an analyst who believes the trend is positive will not have as much incentive to lower estimates even when pessimistic views are shared by numerous forecasters, while analysts who hold negative views will be tempted to raise their estimates towards those of more optimistic analysts.

2.4. Fundamental valuations of cyclical companies

Cyclical companies can be defined as those companies whose "value is often more dependent on the movement of a macro variable than it is on firm specific characteristics" (Damodaran, 2009, p. 1). Such macro variables, such as the state of the economy (as in the automotive industry) or the price of a commodity (as in the steel or oil industries), fluctuate across recessions, peaks, and "normal years" in a cyclical manner. However, at any point in the cycle, it is difficult to predict how these variables will move in the ensuing months or years (Koller et al., 2010). Moreover, cyclical companies usually have volatile operating income and cash flows owing to their high operating leverage, and even more volatile income levels because they often rely on a significant amount of financial leverage (Damodaran, 2009). Consequently, as their operations are more closely linked to exogenous factors than to firm-specific issues, even the most virtuous companies can go bust when a relevant macro variable follows a significantly negative trend (Damodaran, 2009).

As a consequence, the financial statement items needed to undertake a valuation may not be as "reliable" as they are for non-cyclical companies. In any year, certain items, such as earnings, cash flow, capital expenditure, cost of capital, and debt-to-equity ratios, may be biased depending on the phase of the cycle. In other words, if the current

year is the peak of a cycle, an analyst relying on current figures for forecasts and, consequently, for the valuation, risks overvaluing the company, while the opposite could happen in a cycle's trough (De Heer et al., 2000). For this reason, establishing a valuation for cyclical companies is more complex than for non-cyclical companies. Therefore, a valuation technique that relies on current financial data and on forecasts must be carefully adapted in order to limit the risk of misvaluations of cyclical companies. The most notable approaches for addressing this issue are normalized valuations and scenario analysis.

Normalized valuation approaches center on the concept of "normal year", which can be defined as a year in which financial figures of a company are representative of its ordinary cash-flow potential (Damodaran, 2009). One apparently easy way to identify the normal year is to take the most recent cycle, choose a year in which earnings and cash flow were neither "too high" nor "too low", and use it as a base for forecasting future cash flows. This approach is open to critiques regarding its subjectivity. In addition, as it uses only one year out of the many years in a cycle, it fails to exploit all of the informational power residing in the financial statements of the years that are not considered (Damodaran, 2009). In contrast, the average method uses the absolute averages of the relevant financial data across a period that is long enough to cover a complete cycle as the base for normal-year free cash flow. However, as it uses absolute averages as estimates of normal figures, this approach does not recognize that a company can grow substantially either organically or through M&A activity over the course of a cycle. Therefore, the numbers used to compute average data may not be representative of the current or future scale of the business (Damodaran, 2009). One possible solution is to use relative averages rather than absolute averages: in order to estimate normal EBIT, capex, depreciation, and amortization, as well as changes in working capital, one can take the average of their historical relative values (or margins) to revenues (Damodaran, 2009). Hence, the relative-average approach provides estimates for the figures composing free cash flow by finding recurring relationships between a company's financial figures. In other words, the relative-average approach allows users to build a theoretical financial statement that provides normalized figures as an output by exploiting the company's marginality features calculated across an entire business cycle. The relative-average approach can also be based on the sector's average margins in order to overcome the cyclicality issue, even for companies that do not have a long history. Moreover, this methodology can resolve issues related to data unavailability, which may arise because of the small dimension of the company being valued or because of incomplete disclosure of data (Damodaran, 2009).

The scenario-analysis approach (Koller et al., 2010) considers the possibility that past cycles may not be representative of future cycles. Therefore, this approach includes the hypothesis that the most recent trends in the company under analysis will set the basis for new cycles, which will be shaped differently than previous cycles. It calls for the averaging of normalized scenarios and "new cycle scenarios". This exercise requires deep knowledge of the industry to which the company belongs, as well as some structured and robust views on the future of the industry itself (Koller et al., 2010; Damodaran, 2009).

2.5. Hypothesis

The statement that "in an efficient market at any point in time the actual price of a security will be a good estimate of its intrinsic value" (Fama, 1965, p. 56), which represents the cornerstone of market efficiency theories, has been challenged by behavioral finance studies. Furthermore, research shows that cyclical companies' intrinsic values can be more stable than market values over time, thus suggesting that cyclical industries may experience some pricing inefficiencies in periods of cycles' peaks and troughs (Koller et al., 2010).

Hence, this study's hypothesis is the following:

The market enterprise values of cyclical companies are not always unbiased estimates of their fundamental enterprise values.

If market values are good proxies of fundamental values in a market crisis, then they should serve as even better proxies in stable times. In that case, the pillars of efficient market theories would be confirmed. If, instead, the results of the analysis show that market values are not unbiased estimates of fundamental values, at least in a cycle's trough, then market efficiency theory would be challenged, as it requires market values to be good estimates of fundamental values "at any point in time" (Fama, 1965).

The analysis presented here focuses on the recent cycle's trough in the steel sector, which occurred in 2009. As the steel industry is one of the most well-known cyclical industries (Damodaran, 2009; De Heer et al., 2000; Koller et al., 2010), this study's conclusions should be generalizable to other cyclical sectors, or at least serve as a robust starting point for other empirical studies.

3. Methodology

3.1. The sample

The steel sector is cyclical (De Heer et al., 2000; Koller et al., 2010) and companies in the sector are characterized by high levels of financial and operational leverage. Therefore, relevant shifts in the global financial outlook and in steel prices have a significant influence on companies' results (Damodaran, 2009).

The global steel market grew by nearly 50% from 2002 to 2007, with production rising from 905,000 tons to 1,348,000 tons (Worldsteel Association, 2012) in conjunction with the expansion of the global economy during the same period. As a result of the global crisis that began in 2008, global steel production fell by 8% by 2009 (Worldsteel Association, 2010).

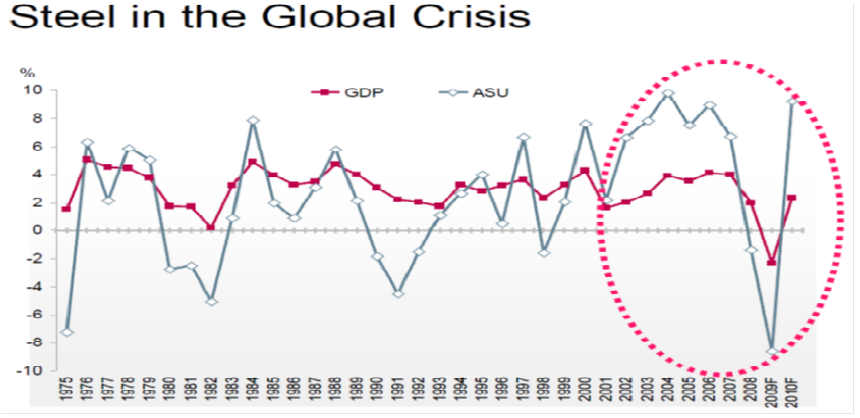
However, the steel market's trends follow a variety of geographical patterns. For example, the market shares held by Europe and the United States fell from 2002 to 2009, while China's market share grew (Worldsteel Association, 2012). More specifically, China held 20% of the global market in 2002, and its market share rose to 36% in 2007 and to 47% in 2009. In addition, Chinese production more than tripled between 2002 and 2009, from 182,000 tons to 577,000 tons (Worldsteel Association, 2012).

Hence, the magnitude of the 2009 crisis can best be understood by excluding the Chinese data. Global production (excluding China) fell from 859,000 tons in 2007 to 660,000 tons in 2009, which represents a 23% decrease (Worldsteel Association, 2012). The worst-performing areas were the United States and Europe (EU 27), which showed

33.9% and 29.7% decreases in steel production, respectively, between 2008 and 2009 (Worldsteel Association, 2010).

Revenues have followed the same pattern. However, in line with the features of cyclical industries, the effects of the 2002 to 2007 expansion and of the 2009 crisis were more pronounced in operating profitability. 2004 has been suggested as the last normal year in operating marginality, while 2007 has been viewed as the cycle's peak (Morgan Stanley, 2012). Furthermore, the 2009 crisis has been labelled as the worst crisis in the steel sector after the Second World War (Citi, 2009), with a sharp contraction in trading, supply, demand, and employment, as well as an increase in production costs (OECD Steel Committee, 2009). The magnitude of the 2009 steel crisis is evident in the following figure (figure 1), which offers a comparison of apparent steel use (ASU), which is an indicator of steel demand, and global GDP growth.

- **Figure 1**



Source: Worldsteel Association (2009)

If stock prices in the steel sector are unbiased estimates of fundamental values even in such a critical moment, then they should be good proxies of fundamental values in stable times. If, instead, this is not the case, then market values should not be viewed as unbiased estimates of fundamental values, at least in periods of global economic trouble.

The sample used for the analysis is composed of companies belonging to the Bloomberg clusters of "Steel Producers" and "Steel Specialties". Steel Producers manufacture steel slabs, blooms, billets coils, and rods, while the products of Steel Specialties companies include electrical, alloy, stainless, and tool steels (details were drawn from Bloomberg's descriptions, as Bloomberg's clustering method relies on a proprietary algorithm). Of the approximately 600 companies classified by Bloomberg in the chosen clusters, we selected 45 headquartered in 21 different countries. Our sample selection was based on several considerations.

For headquarters and subsidiaries classified in the same group, Bloomberg reports the figures of the mother company and those of the listed subsidiaries. In order to avoid double counting, we did not include data related to subsidiaries. Moreover, Bloomberg classifies companies as "Steel Producers" and "Steel Specialties" even if their operations are not exclusively (or mainly) linked to the steel sector. Therefore, we checked revenue segmentation for all companies. Those companies with a main source of revenue not linked to the steel industry were excluded from the sample. In addition, several companies with incomplete data were removed from the list. Then, in order to avoid including companies with a fundamental enterprise value lower than zero, outliers were eliminated from the sample. In this step, those companies with the worst performance and an equal number of the best-performing companies were removed in order to maintain the representativeness and the symmetry of the sample. More specifically, the ten best- and worst-performing companies in terms of average EBIT margin were excluded. Lastly, we selected the companies with a 2009 market enterprise value exceeding one billion euro (45 companies), as we assume that size is directly correlated with maturity. Mature, large companies typically show lower variability in financial figures than younger firms, and they are less likely to change dramatically in terms of industry focus, dimension, or performance from one year to the next. Therefore, they are generally easier to analyze and they tend to produce more reliable results (Damodaran, 2001).

3.2. Choices regarding evaluation and cycle

The free cash flow to firm (FCFF) model entails calculating a company's enterprise value as the sum of all of the discounted "future cash flows to all claim holders in a firm, including stockholders, bondholders, and preferred stockholders" (Damodaran, 2001, p. 382). The steady-state simplified version of the FCFF valuation approach relies on the assumptions that the company's cash flows will grow at a constant rate in the future, that capital expenditure is equal to depreciation and amortization, and that there is no change in working capital from year to year. This approach can be used in the valuation of mature companies (Damodaran, 2009). The model is written as follows:

$$EV = EBIT*(1-t)/(WACC-g).$$

Equation 1

The 45 companies in our sample were all active in the established steel industry. Therefore, these companies can be considered as mature. Hence, it seemed appropriate to use the normalized version of the simplified steady-state FCFF model to identify the intrinsic values of the companies in the sample.

Numerous paths can be followed in order to adapt valuation models to the features of cyclical companies. In this study, we adopt the relative average method. As estimates based on the relative average method rely on the marginality of relevant past financial data rather than on absolute values, we are able to exploit their informational power and to address issues concerning possible changes in the scale of businesses. The other methods described above cannot provide sufficiently accurate estimates. On the one hand, they sometimes fail to recognize marginality (e.g., the average method). On the other hand, they may rely on overly strong and arbitrary assumptions (e.g., scenario analysis) (Damodaran, 2009).

As discussed in the literature review, all of the approaches to valuing cyclical companies must address the identification of the cycle and, therefore, the data to be used in calculations. In order to identify the steel industry's cycle, we analyzed the 2002 to 2009 EBITDA, EBIT, and EBIT margins of the 45 companies included in the sample (see figures below).

The profitability of the steel industry changed dramatically across the 2002 to 2009 time span. The average EBIT and EBITDA graphs highlight a business cycle with 2007 and 2008 as peaks, and 2002, 2003, and 2009 as troughs.

However, if one considers the average revenue figures, a different pattern is evident, shaping a cycle running from 2006 to 2009. In fact, average revenue in 2006 is comparable to average revenue in 2009, while it reaches a peak in 2008.

In the context of this paper, it appears that choosing the 2002-2009 EBIT-EBITDA cycle would involve the risk of including profitability features that are not representative of the steel business in the fundamental valuation of the companies under analysis.

More specifically, if we use the 2002 to 2009 period as a proxy of the steel sector's business cycle, the high margin figures seen in the first six years would outweigh the lower values seen in 2008 and 2009 in the averaging exercise:

this would most likely produce positively biased valuations. Indeed, the averaging of many high figures with only few low figures results in a high figure; in the context of this analysis, a high figure could actually be positively biased estimate.

Figure 2

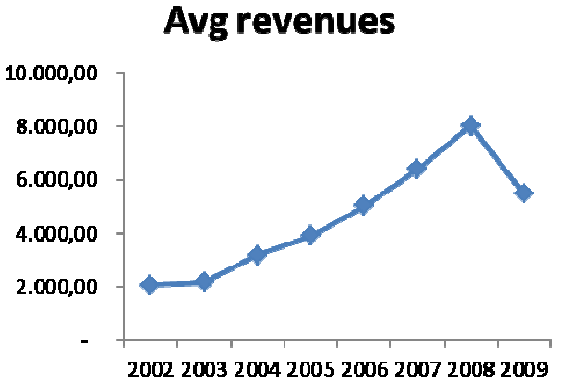
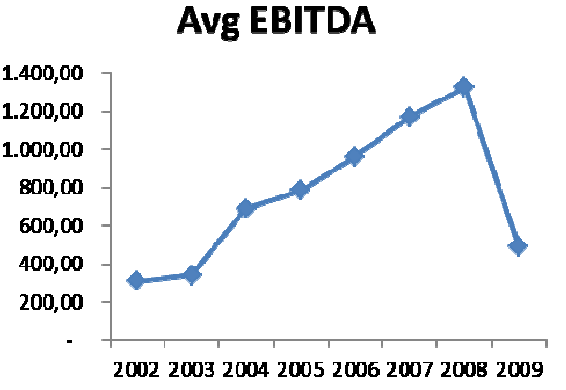
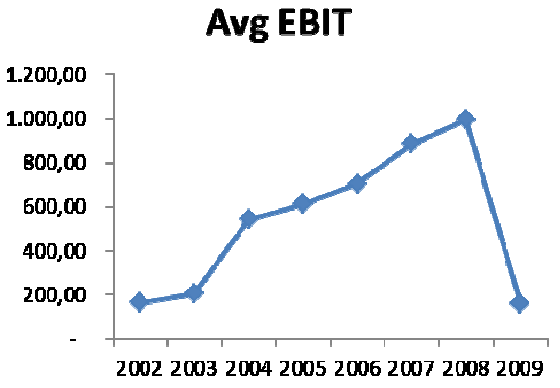
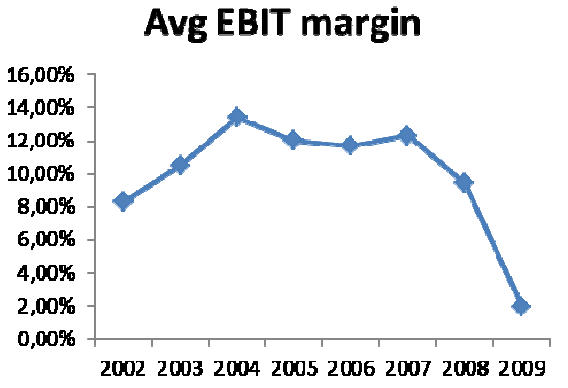


Figure 3



Source: Bloomberg
Data expressed in million Euros.





Source: Bloomberg
Data expressed in million Euros.

Figure 4 **Figure 5**

On the other hand, the application of the relative average method to the years from 2006 to 2009 would result in an almost equal weighting of the high margin figures of 2006 and 2007 and the lower margin figures of 2008 and 2009: in this manner, a good estimate of the steel sector's average profitability can be derived.

3.2.4 Model for fundamental valuation

In order to apply the steady-state FCFF model, it is necessary to normalize the following financial figures: EBIT, the tax rate, the WACC estimation, and the steady-state growth rate.

To estimate EBIT, we multiplied the 2006-2009 average EBIT margins by the 2009 revenue figures for the companies in the sample. This is in accordance with the relative average method (Damodaran, 2009). The equation is as follows:

$$EBIT = Revenues_{2009} * \text{average EBIT margin}_{2006\text{-}2009}.$$

Equation 2

The 2009 marginal corporate-tax rate was assigned to each company in the sample according to the country in which it was headquartered. When dealing with multinationals, such as the companies in our sample, at least two paths can be followed to identify the relevant tax rate. The first method entails using a weighted average of the marginal tax rates of the countries in which the company generates income, with weights proportional to the amount of income generated in each country relative to total income. However, this approach fails to recognize that the weights vary from year to year, and therefore results in estimates that cannot be considered reliable in the long term (Damodaran, 2001). Second, the tax rate of the country in which the company is headquartered can be used. This approach, which is adopted in this paper, relies on the assumption that "the income generated in other countries will eventually have to be repatriated to the country of origin, at which point the firm will have to pay the marginal tax rate" (Damodaran, 2001, p. 249). Notably, no averaging has been applied in the identification of the mar-

ginal tax rates for two reasons. The first is the simple observation that changes in marginal corporate-tax rates are rare (KPMG, 2013). The second is that shifts in tax rates are unlikely to be linked to the steel sector's cycle. In other words, there is no empirical evidence or logical reason for the existence of a relationship between the steel sector's business cycle and changes in marginal corporate-tax rates.

To perform the WACC estimation, it is necessary to remember that cyclical sectors are not only characterized by volatile revenues, margins, and operating income, but also by shifts in the cost of capital (Damodaran, 2009). Therefore, the normalized WACC of each company in the sample was calculated as an average of the Bloomberg WACC figures from 2006 to 2009, which corresponds to the time span chosen for the average EBIT-margin calculations.

We used the inflation rate as a proxy for the steady-state growth rate and the same growth rate for all companies in the sample. A steady-state model assumes that the company being valued has already reached its maturity and will perpetually grow at the same rate without changing its competitive position among its peers. Consequently, as "a company that is neither gaining nor losing ground will nonetheless see its cash flows increase over time at a rate equal to that of inflation" (Clough and Rotkowski, 2013, p. 18), the historical inflation rate can be assumed to be a good proxy for the steady-state growth rate. The reasons for using the same growth rate for all companies in the sample lie in their maturity, dimensions, and global reach. As each company analyzed in this paper is a large multinational with global operations, it seemed appropriate to assume a common global growth rate. We used a growth rate of 5.34%, which is the global average inflation rate calculated by the World Bank "as measured by the annual growth rate of the GDP implicit deflator which shows the rate of price change in the economy as a whole." The GDP implicit deflator is "the ratio of GDP in current local currency to GDP in constant local currency" (World Bank website).

The described model, which is labelled "Model A", is formalized as follows:

$$EV = Rev_{2009} * EBIT\ margin_{2006\text{-}2009} * (1\text{-}t_{2009}) / (WACC_{2006\text{-}2009}\text{-}g)$$

Equation 3

where "EV" stands for enterprise value; "Rev_{2009}" is the 2009 revenue figure; "EBIT $margin_{2006\text{-}2009}$" is the average EBIT margin between 2006 and 2009; "t_{2009}" is the 2009 marginal tax rate of the country in which each company was headquartered; "$WACC_{2006\text{-}2009}$" is the average WACC between 2006 and 2009; and "g" is the steady-state growth rate.

We also considered the fact that the 2009 crisis brought not only a deep trough in terms of declining margins but also in terms of revenue (Worldsteel Association, 2012). Therefore, it seemed appropriate to build another model able to reflect cyclicality in revenue and margins.

The alternative model is identical to the one described above in all its components apart from the EBIT estimate, which we obtained by multiplying the 2006-2009 average EBIT margin by 2006-2009 average revenue. This modification addresses the risk that the low revenue in 2009 may lower the EBIT estimate, thereby resulting in possible undervaluations. If an average EBIT margin is multiplied by a very low revenue figure (such as the revenue figures posted by steel companies in 2009), then the EBIT estimate

could still be lower than normal even though the relative average method has been correctly applied.

This alternative model, which is labelled "Model B", is formalized as follows:

$$EV = Rev_{2006\text{-}2009} * EBIT\ margin_{2006\text{-}2009} * (1-t_{2009}) / (WACC_{2006\text{-}2009} - g)$$

Equation 4

where: "EV" stands for enterprise value; "$Rev_{2006\text{-}2009}$" is the average revenue between 2006 and 2009; "EBIT $margin_{2006\text{-}2009}$" is the average EBIT margin between 2006 and 2009; "t_{2009}" is the 2009 marginal tax rate of the country in which each company was headquartered; "$WACC_{2006\text{-}2009}$" is the average WACC between 2006 and 2009; and "g" is the steady-state growth rate.

3.3. The analysis of market efficiency

Market efficiency theories suggest that market values are always unbiased estimates of fundamental values (Fama, 1965). In order to test this statement in the context of our analysis, our first step was to check whether the distribution of fundamental values, calculated according to the described methodologies (Models A and B), and the distribution of market enterprise values had the same shape.

The distributions of fundamental enterprise values in Model A and Model B, as well as the distribution of market enterprise values were tested for normality using the Shapiro-Wilk test. As the data were not found to be normal, non-parametric Wilcoxon signed-rank tests with paired data were used to perform the comparative exercise.

As a control, the distributions of the percentage differences between the fundamental and market values, which were labelled as "Delta A" and "Delta B", were tested for normality using the Shapiro-Wilk test. The data were again not found to be normally distributed, and Wilcoxon signed-rank tests were therefore employed to verify whether Delta A and Delta B had medians that were statistically different from zero.

This process is a necessary, but not sufficient, method for verifying whether market values are always unbiased estimates of intrinsic values. Indeed, according to efficient market theories, market values and fundamental values can differ as long as the difference is random. In other words, for markets to be efficient, the difference between market values and fundamental values cannot be attributable to any explicative variable (Damodaran, 2001).

Therefore, we performed two regressions analyses in which the percentage differences between the fundamental and market enterprise values, Delta A and Delta B, were the dependent variables. The predictors of the regression analyses were the elements composing the fundamental FCFF models employed in the valuation of the companies in the sample, as well as geographical dummy variables based on the country in which each company was headquartered. Therefore, the predictors in the Delta A regression are: the 2009 revenues, the 2006-2009 average EBIT margins, the marginal corporate-tax rates, the average WACCs, the steady-state growth rate, and the geographical dummy variables. The predictors in the Delta B regression are the same as in the Delta A regression, although the 2009 revenue figures were substituted with the 2006-2009 average revenue data in accordance with Model B.

The two regressions were performed using the robust standard-error approach in order to avoid heteroskedasticity issues. In addition, multicollinearity was analyzed using

variance inflation factors (VIF). Only two non-statistically-significant predictors (the geographical dummy variables of Asia and North America) exceeded the limit of 10.

Finally, the theoretical difference between Model A and Model B that is related to the different estimations of normalized EBIT is not enough to justify their parallel employment in the verification of market efficiency. Therefore, it seemed necessary to verify whether Model A and Model B produced statistically different results. Hence, a Wilcoxon signed-rank test with paired data was performed on the distributions of the fundamental values obtained through Model A and Model B. In addition, a regression analysis (with robust standard errors) was performed, with the difference between Model A and Model B fundamental values as the dependent variables, and the geographical dummy variables as predictors.

4. Results

Our hypothesis suggests that market enterprise values are not always unbiased estimates of the fundamental values of cyclical companies. In this regard, the Wilcoxon signed-rank tests analyze the difference between the market and fundamental values of the companies in the sample. The results of the tests are summarized in Table 1.

- **Table 1: Wilcoxon signed-rank test**

	Model A		**Model B**		**Delta A**		**Delta B**		
	Obs	Sum ranks	Obs	Sum ranks	Obs	Sum ranks	Obs	Sum ranks	Expected Sum ranks
Mkt > Fond	16	311	12	187	16	249	12	195	517.5
Mkt < Fond	29	724	33	848	29	786	33	840	517.5
p<		0.0198		0.0002		0.0024		0.0003	

The tests indicate that the distribution of market values differs from the distribution of fundamental values. Moreover, the "sum ranks" of the four tests suggest that market values are consistently lower than fundamental values, thereby demonstrating an undervaluation of the steel sector during the 2009 cycle's trough.

As previously explained, this evidence is a necessary, but not a sufficient, condition for the detection of market inefficiencies in pricing intrinsic values. The efficient market framework allows market values and fundamental values to differ as long as their differences are random. To address this issue, the descriptive statistics and the results of the regression analyses are presented in Tables 2 and 3.

Table 2: Descriptive statistics and correlations

		Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1	Rev 2009	5.093,94	6.785,08	1,00											
2	Avg EBIT margin 2006-09	0,09	0,06	0,19	1,00										
3	Avg Wacc 2006-09	0,92	0,23	0,23	0,44 **	1,00									
4	Tax Rate	0,29	0,06	0,23	0,20	0,41 **	1,00								
5	Growth Rate	0,05	0,00												
6	Asia	0,62	0,49	-0,16	-0,27	-0,55 **	-0,42 **		1,00						
7	Europe	0,20	0,40	0,19	0,22	0,12	-0,07		-0,64 **	1,00					
8	North America	0,11	0,32	-0,01	-0,02	0,61 **	0,70 **		-0,45 **	-0,18	1,00				
9	South America	0,02	0,15	0,10	0,14	0,24	-0,10		-0,19	-0,08	-0,05	1,00			
10	Africa	0,02	0,15	-0,08	0,23	-0,13	0,12		-0,19	-0,08	-0,05	-0,02	1,00		
11	Australia	0,02	0,15	0,01	-0,04	0,05	0,03		-0,19	-0,08	-0,05	-0,02	-0,02	1,00	
12	Delta A	0,91	2,49	-0,12	0,06	-0,41 **	0,08		0,18	-0,10	-0,19	-0,06	0,15	-0,00	1,00

		Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1	Avg Rev 2006-09	6.068,53	9.597,53	1,00											
2	Avg EBIT margin 2006-09	0,09	0,06	0,17	1,00										
3	Avg Wacc 2006-09	0,09	0,23	0,26	0,44 **	1,00									
4	Tax Rate	0,29	0,58	0,29 †	0,20	0,41 **	1,00								
5	Growth Rate	0,53	0,00					1,00							
6	Asia	0,62	0,49	-0,25 †	-0,27 †	-0,55 **	-0,42 **		1,00						
7	Europe	0,20	0,40	0,27 †	0,22	0,12	-0,07		-0,64 **	1,00					
8	North America	0,11	0,32	0,05	-0,02	0,61 **	0,70 **		-0,45 **	-0,18	1,00				
9	South America	0,02	0,15	0,08	0,14	0,24	-0,10		-0,19	-0,08	-0,05	1,00			
10	Africa	0,02	0,15	-0,06	0,23	-0,13	0,12		-0,19	-0,08	-0,05	-0,02	1,00		
11	Australia	0,02	0,15	-0,01	-0,04	0,05	0,03		-0,19	-0,08	-0,05	-0,02	-0,02	1,00	
12	Delta B	0,95	2,18	-0,11	0,13	-0,40 **	0,06		0,04	0,04	-0,19	-0,06	0,24	-0,01	1,00

* p<0,05; ** p<0,01; † p<0,10

The strongest correlations are evident between the dependent variable and the "Average WACC 2006-2009" predictor.

- **Table 3: Regression analyses**

	Delta A	**Delta B**
Constant	1,46	4,96
Rev 2009	0,00	*Not applicable*
Avg Rev 2006-09	*Not applicable*	0,00
Avg EBIT margin 2006-09	13,50*	14,74*
Avg WACC 2006-09	-75,34†	-78,30*
Tax rate	15,45	7,99
Growth rate	*Omitted*	*Omitted*
Asia	1,06	-0,61
Europe	0,86	0,16
North America	0,93	0,86
South America	2,78	1,32
Africa	*Omitted*	*Omitted*
Australia	1,59	0,36
R^2	0,34	0,37

* $p < 0,05$; ** $p < 0,01$; † $p < 0,10$

The "average EBIT margin 2006-2009" and the "average WACC 2006- 2009" predictors are statistically significant. The p-values of the "average EBIT margin variable" are lower than 0.05 in both regressions. The p-value of the "average WACC" variable in the Delta A regression is slightly higher than 0.05 (0.051), while in the regression of Delta B it is lower than 0.05.

Therefore, the combined results of the Wilcoxon signed-rank tests and the regression analyses support the hypothesis. We find that not only do the distributions of the 2009 market values and fundamental values differ, but the two predictors are also statistically significant in explaining the difference between the two distributions. In addition, the results of the Wilcoxon signed-rank test suggest that the detected market inefficiency led to an undervaluation of the steel sector in 2009.

The analysis of market efficiency in pricing cyclical companies is based on a comparison of the market enterprise values and the fundamental enterprise values obtained through Models A and B. The Wilcoxon signed-rank test analyzes the difference be-

tween the fundamental enterprise values derived through Model A and Model B. The test indicates that the distributions of Model A and Model B are notably different (p-value: 0.07).

Moreover, the test highlights that fourteen of the nineteen companies for which the Model A fundamental value was higher than the Model B fundamental value are Chinese. At the same time, only five of the twenty-six companies with a lower fundamental value in Model A than in Model B are Chinese. In addition, the results of the regression analysis show that the geographical dummy variable of Asian companies has a positive coefficient and a high level of statistical significance.

5. Discussion

5.1. Market inefficiency in cycles' troughs

This paper has tested the pillars of market efficiency theories in the context of a cyclical industry's trough. The results of the analysis suggest that markets are not always efficient in pricing cyclical companies. More specifically, markets apparently fail to recognize average margins and average WACCs as factors influencing cyclical firms' intrinsic values. In fact, these two predictors are statistically significant in the explanation of the difference between market and fundamental values. In addition, the regression coefficients of the average EBIT margins and the average WACCs are positive and negative, respectively, in accordance with general principles of corporate valuation. Indeed, high EBIT margins, which are representative of good operational efficiency and profitability, should result in high estimates of future cash flows and, thus, in high fundamental enterprise values. Moreover, low WACC figures, which suggest low risk, imply that cash flow projections are discounted according to a low discount factor and should therefore have a positive impact on fundamental enterprise values (Damodaran, 2001). However, the Wilkoxon signed-rank tests indicate that the detected biases in market prices are actually negative biases, which suggests that markets undervalue cyclical companies during industry-wide crises.

Consequently, the combined results of the regression analyses and the Wilkoxon signed-rank tests show that cyclical companies are undervalued during cycles' troughs, even when they have good fundamentals (e.g., good average operating margins and low average costs of capital). Volatility in EBIT margins and WACCs is a key feature of cyclical companies, which is incorporated into the fundamental valuation models used here, mainly due to the dependence of these companies' performances on the global economic outlook. Markets do not seem to recognize this factor and therefore undervalue cyclical companies in turbulent periods.

Behavioral finance theories may help explain why these biases can arise in market enterprise values. For instance, the impact of noise traders' decisions (Shleifer and Summers, 1990) and their "anchored" beliefs (Kahnemann and Tversky, 1974) could be relevant in the undervaluation of cyclical companies during troughs. Irrationality of traders could have a significant impact on market values in the same way as it did during the market crisis of 1987, through contagion of fear and panic spreading among investors (Shiller, 1987), and companies' insiders may also exacerbate the bias in market values by profiting from mispricing by exploiting private information, as it happened during the

same crisis (Seyhun, 1990). In conclusion, these elements may also imply that undervaluations in market prices could persist over time (Barberis and Thaler, 2003).

5.2. Considerations for analysts valuing cyclical companies

The empirical analysis has shown that market enterprise values of cyclical companies may not always be unbiased proxies of their fundamental enterprise values. Even though the focus of the work is limited to the steel industry and to one specific moment - the 2009 steel sector crisis – the finding appears to be relevant on a more general level, particularly with respect to analysts who want to value cyclical companies. Indeed, the logical consequence of the market inefficiency detected in this paper is that, since market values that are not always unbiased estimates of fundamental values, they should be carefully checked and backed up through the attentive application of fundamental valuation techniques, and not simply taken as the best reference for valuation. In addition, it is worth highlighting that such approach should be applied at least with respect to business cycles' turning points, such as the steel cycle's through of 2009; indeed - as shown in the empirical analysis - market values may be biased proxies of fundamental values particularly in such moments of the business cycle.

5.3. Managerial considerations

In this paper, fundamental enterprise values, which represent the intrinsic values of companies, have been compared to Bloomberg enterprise values, which are assumed to be good proxies of market enterprise values. Bloomberg enterprise values result from the sum of the market value of equity, the book value of the net financial position, and the book value of minorities. Fundamental enterprise values are the sum of the intrinsic values of equity, net financial position and minorities. Hence, the finding that cyclical companies' fundamental enterprise values are higher than market enterprise values during cycles' troughs may be the result of one of (or a combination of) the following: equity's intrinsic value is higher than equity's market value; the net financial position's intrinsic value is higher than the book value of net financial position; or minorities' intrinsic value is higher than the book value minorities. This discussion is based on the assumption that minorities are the least-relevant component (in terms of amount) of enterprise values. Therefore, the focus is on equity and net financial position.

As smart managers can recognize mispricings by irrational investors, they are able to exploit the irrationality of market players with the aim of creating value for their companies (Barberis and Thaler, 2003). Hence, smart managers of cyclical companies should first recognize whether the undervaluation of their companies' market enterprise values is caused by a bias in the equity value or in the net financial position value. If they find that equity is undervalued, they may decide to apply a "market timing" strategy in which they repurchase a portion of the outstanding stock in order to sustain the price. In fact, evidence shows that buybacks have a positive impact on prices and that the greater the buyback, the greater the positive effect (Stein, 1996). However, this strategy shall not impact investments in order not to destroy value (Barberis and Thaler, 2003). One way to undertake stock repurchases without eroding capital resources for investments is the construction of ad-hoc reserves during peak or boom periods, which are characterized by high cash flows (Baker and Wurgler, 2011; Barberis and Thaler, 2003; Stein, 1996).

On the other hand, if the intrinsic value of the net financial position is higher than its book value, this could mean that the market feels that the company is less risky than it was when it last published a financial statement (fundamental valuation is not performed only on the dates on which financial statements are published). In this case, future cash outflows could be discounted at a lower cost of debt. This may be the case for companies that have lowered their reference risk-free rates or CDS spreads between the date of fundamental valuation and the publication of the financial statements. In such situations, a smart manager may consider renegotiating the terms and conditions of the company's debt with banks in light of reduced risk associated with the company. However, this scenario is not the only one in which the intrinsic value of the net financial position could be higher than the book value. Such a difference could be due to the opening of new debt positions between the publication of financial statements and the time of the fundamental valuation, associated to the investment of the new resources. If the company is run by a smart manager, the new debt may have been used to finance NAV-positive investments, thereby increasing the fundamental enterprise value.

Moreover, when the market undervalues companies, smart managers may consider behavioral signaling strategies, such as publicly announcing investments in research and development, or joint ventures, product strategies, and capital expenditure (Chan et al. 1990). However, in order to be able to finance these investments, smart managers must build cash reserves during market booms or peaks.

5.4. The difference between Model A and Model B

Our fundamental valuations were undertaken using two models: Model A and Model B. Both models were based on normalizations derived through the relative average approach.

Regression analyses of Delta A and Delta B gave similar results. In addition, neither current revenue nor the average cycle's revenue were found to be statistically significant in explaining the difference between market and fundamental values. However, the Wilcoxon signed-rank test indicated that the distributions of Model A's and Model B's fundamental enterprise values were quite different (p-value: 0.07). As only one element differs in the models, even a weak statistical significance of the difference in their results is interesting.

In addition, most of the companies with Model A fundamental values higher than their Model B fundamental values were Chinese. At the same time, only a few of companies with Model A fundamental values lower than their Model B fundamental values were Chinese. Therefore, as Model A valuations can be higher than Model B valuations only if the average revenue in the cycle is lower than current revenue, this observation seems to confirm that Asian companies have not suffered from the impact of the 2009 crisis as much as companies from other countries. Furthermore, the regression analyses testing the significance of these empirical observations highlighted that the geographical dummy variable of Asian companies had a positive coefficient and high statistical significance.

Hence, the combined results of the Wilcoxon signed-rank test and the regression analyses imply that an analyst valuing a cyclical company may need to consider not only cyclicality at the operating income level, as in Model A, but also at the revenue level, as in Model B.

In the case of the steel-sector analysis, Asian companies' fundamental values may be better estimated using Model A, as cyclicality only impacted their operating profitability. Companies from other regions may be better valued using Model B, as cyclicality affected both their revenues and their operating profitability.

6. Consclusions

6.1. The analysis

A debate concerning market efficiency has been underway in global financial and economic research for decades. Market efficiency theories suggest that market values of companies are unbiased estimates of their intrinsic values at any point in time. In contrast, behavioral finance studies claim that markets are not always efficient and that investor sentiment drives market prices.

Within this theoretical framework, this study focuses on the analysis of market efficiency with particular reference to cyclical industries, which are characterized by volatile financial figures and unstable market values. The study demonstrates that market values of cyclical companies are not always unbiased estimates of their intrinsic values, as market efficiency theories would instead suggest. Moreover, the results also suggest that markets may undervalue cyclical companies during cycle's troughs. These findings, which challenge market efficiency theories, may have interesting implications for analysts and managers. They suggest a need to avoid relying completely on market values, particularly during cycle's troughs, when valuing cyclical companies and when making managerial decisions.

6.2. Shortcomings of the analysis

The first shortcoming of this paper is its focus on a single cyclical industry. Nevertheless, the steel industry is one of the main cyclical industries and it has recently experienced a major crisis. As such, it offers an interesting context for tests of market efficiency.

Second, the sample only comprises mature companies. However, this has allowed for the exploitation of normalized steady-state models, which rely on the only assumption that future business cycles will resemble the most recent business cycles. More complex models based on multiple assumptions would have been needed if this study had addressed a sample including less-mature companies.

Third, the market values and fundamental values were compared at the enterprise value level and not at the equity value level. Nevertheless, in the context of the analyzed market trough, fundamental valuation would not have been feasible through equity-side valuation approaches that rely on net income figures. Throughout the 2009 crisis, the net incomes of most of the steel companies were negative, which made the application of equity-side evaluation techniques impossible.

6.3. Avenues for future research

This study provides an empirical verification of market inefficiency related to mature companies active in a specific cyclical industry. Researchers might wish to expand the

analysis to other cyclical industries in order to investigate whether the findings of this paper are consistent with all cyclical industries. In addition, empirical tests of market efficiency could be performed at cycles' peaks in order to verify whether cyclical companies are overvalued in such periods. Finally, the analysis could be extended to non-mature companies through the exploitation of more sophisticated fundamental valuation approaches.

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