The aim of this paper is to grasp the processes underlying the genesis and assessment of synergies in M&A deals. We proceed to an in-depth scrutiny of the foundations of synergies using Porter’s model of the value chain. A discernment of the nature of synergies and the mode of their emergence is helpful to clarify to what extent and under which boundary conditions it is appropriate to apply the DCF or the real option techniques for evaluating each type of synergy. Combining both financial tools, the methodology suggested for evaluating the synergies is able to: evaluate projects of M&As, orient the selection of target firms and the definition of the premium of acquisition, and drive the integration processes.

Key words: merger, acquisition, synergy, Porter’s value chain, evaluation.

1. INTRODUCTION

In recent decades, M&A research in managerial literature and corporate finance studies has developed rapidly. These advances include a handful of ideas about the nature, antecedents, and economic and financial impact of business combinations (Meglio and Capasso, 2012). However, the debate about the shareholder value creation of businesses combinations has resulted in partial and inconsistent conclusions (Haleblian et al., 2009). Mapping the main studies, institutionalized streams, and dominant theoretical explanations, Ismail et al. (2011) concluded that research on the effect of M&A on abnormal returns for both acquiring and acquired firms is inconclusive (Tse and Soufani, 2001; Andre, Kooli and L’Her, 2004; Choi and Russell, 2004; Megginson et al., 2004; Yook, 2004); similarly, studies that use accounting-based measures show contradictory positions (Ghosh, 2002; Heron and Lie, 2002; Ramaswamy and Waegelein, 2003). In addition, King et al. (2004) indicated that unidentified variables may explain the significant variance in post-acquisition performance. Moreover et al. (2008) found a path linking integration process performance to long-term firm results via synergy achievement.

In approaching the topic of M&A performance, Sirower (1997) argued that the key to understanding the dynamics underlying the performance of M&A is the comparison between the amount of premium of acquisition (that is negotiated between the parties) and the value of synergies that a business combination generates.

The choice to acquire a firm or merge with another firm should result from a well-developed corporate strategy (Payne, 1987). Conversely, the lack of understanding of the nature and sources of synergies and their appropriate evaluation results in exceeding the reservation price and leads to the “synergy trap” (Sirower, 1997) i.e., a downward spiral that involves the progressive and incremental destruction of wealth. More in detail, the mechanisms underlying the “synergy trap” are (a) the improper transfer of resources from stockholders of the acquiring firm to shareholders of the target, (b) increase in risk-seeking behavior and baring-risk by management and the pressure to recover from poor performance following the completion of the transaction, and (c) the negative effects and costs associated with drainage of financial resources that are vital to supporting the initial integration processes and operational strategic business combinations.

Taking into account that the acquisition premium plays a key role in M&A performance (Sirower, 1997; Krishnan et al., 2007), and continuous need of practitioners to obtain results that can be helpful to manage M&A processes (Very, 2011), the object of this paper is to discern the main variables that are instrumental in creating or destroying value in M&A deals in the process of synergy evaluation. First, we examine the procedural aspects - operational, functional, organizational, and strategic - that are the basis of
value creation in M&A deals. Successively, we categorize the various sources of synergy and how best to evaluate each of them. Therefore, we develop a methodology to assess the synergy value that is the result of a path of research that lies at the intersection of strategic management and corporate finance. We address the need to integrate valuation tools from corporate finance and principles from the fields of strategic management to better understand value creation in financial markets (Smit and Trigeorgis, 2004; Sirower and Sahni, 2006).

This paper is organized as follows. Section two aims to clarify the concept of synergy. In section three, using Porter’s value chain as a conceptual support, we conduct a detailed investigation of the sources of synergies in the operations of M&A. In section four, we classify the various sources of synergies previously identified on the basis of the degree of predictability. We then discuss the scheme guide in the choice of valuation techniques for each class of synergies. In section five, we present synthetic formulas for evaluating synergies in M&A. Section six offers conclusions, underscoring the problem of the appropriation of synergy value.

2. CONCEPTUAL DEVELOPMENT

The term “synergy” comes from the Greek word synergia or synergeia; in turn, this word is derived from synergo. From an etymological perspective, the roots of the word synergy are syn (“with, together”) and ergo (“act”). Synergy concerns the results of different factors taken together versus a sum of the factors.

From an etymological point of view, the concept of synergy possesses a neutral meaning: the joint effect of two or more factors is different from their simple sum. Consequently, the synergy value may be positive, if a combination of factors improves the effectiveness of actions alone, or negative, if the result of joint action of two or more factors is less than their simple sum.

Generally, the justification of M&A operations is the intention to create positive synergies. It means that the value of the business combination is assumed expected to be greater than the value of the two firms considered independently:

\[ W_{AB} > W_A + W_B, \]

\[ W_{AB} = W_A + W_B + S, \]

where \( W_{AB} \) is the value of the business combination, \( W_A \) and \( W_B \) are respectively the values of firms A and B, and S is the value of the synergies emerging from the combination.

However, as already mentioned, the empirical studies regarding the results of M&A operations show high variability (Hitt et al., 2001); therefore, it is also important to consider the possibility that negative synergies emerge.

\[ W_{AB} < W_A + W_B, \]

\[ W_{AB} = W_A + W_B - S. \]

Only detailed strategic planning and hardnosed economic assessment of the costs and benefits entitled by post-acquisition operational processes can provide the necessary basis for a rational estimate of the potential synergies entailed by specific M&A operations. This evaluation, therefore, entails the integration of perspectives and techniques from the field of both strategy and finance. It needs bringing strategy back into financial systems of measurement (Mocciaro Li Destri et al., 2012). Essentially, the generation of synergies is linked with corporate growth, increased market power, and greater profitability (Alexandridis et al., 2010). Therefore, the assessment of synergies implies estimating the “strategic fit” (Shelton, 1988), and, successively, shareholders’ value creation. Actually, paying a high acquisition premium is often a measure of low-quality decision making (Laamanen, 2007).

The breakings down of the acquisition value and of the synergy value have been analyzed in the finance literature (Massari, 1998; Zanetti, 2000). On the basis of Massari and Zanetti’s models, the formulation of a measurement method should include three types of synergies. The first type, incremental cash flow synergies (\( S_I \)), concerns the cash flows that the business combination generates according to a plan of integration. The second type of synergies is related to flexibility. The real options synergies (\( S_O \)) concern how the business combination increases the firms’ capability to respond to the evolution of the competitive environment. Actually, real options analysis has progressively emerged as a pivotal methodology to assess investment opportunities when the environments are characterized by high levels of uncertainty (Dixit and Pindyck, 1994). This synergy, thus, aims to capture the flexibility value resulting from the firm’s adaptive capabilities (Smit and Trigeorgis, 2004). Finally, the third type of synergies regards the change of the firms’ risk profile (\( S_R \)) as a result of the operation of M&A.

Moving from the conceptual break-down of the notion of synergies in M&A operations, it becomes apparent those in order to aid managerial evaluations there is the necessity and classify the
sources of different classes of synergies and, further, elaborate specific evaluation techniques for each class of synergies.

In synthetic terms, the equity value of the synergies will be calculated as follows:

\[ S = S_F + S_O + S_R. \]

Therefore, the estimated value of a business combination - assuming the DCF in asset perspective - ideally consists of the following elements:

\[ W_{AB} = [(\overline{W}_A - D_A) + (\overline{W}_B - D_B)] + \overline{S}_F + \overline{S}_O + \overline{S}_R - \Delta D_{AB}. \]

Where:
- \( \overline{W}_A \) e \( D_A \) represent the value of the assets and the value of debt for the firm A;
- \( \overline{W}_B \) e \( D_B \) represent the value of the assets and the value of debt for the firm B;
- \( \overline{S}_F \), \( \overline{S}_O \) e \( \overline{S}_R \) indicate the estimated value of synergies classified as above; and
- \( \Delta D_{AB} \) Indicates the change in value of total debt.

Simplistically, we can rewrite the [6] formula as:

\[ W_{AB} = (\overline{W}_A + \overline{W}_B) + (\overline{S}_F + \overline{S}_O + \overline{S}_R) - (D_A + D_B + \Delta D_{AB}). \]

The formula [7] asks an effort to categorize the synergies in \( \overline{S}_F \), \( \overline{S}_O \) e \( \overline{S}_R \) on the basis of the nature and the mode to emerge of them.

3. THE GENESIS OF SYNERGIES IN M&A OPERATIONS

In this section, we identify the various sources of potential synergies in M&A operations. Using Porter's model of the value chain (Porter, 1985) as a conceptual support to investigate the processes of structural integration between firms, we analyze the operational and strategic impact of M&A deals. By following this practice, we aim to give a twofold contribution. On one hand, we underscore the integration priorities “that should precisely match the value and type of synergies that drove the deal in the first place” (Ficery et al., 2007). In this perspective, the aim of the analysis is to find profit-making opportunities (Bruner, 2004). Actually, our analysis shows the foundations of sustained competitive advantages generated by potential synergies (Gruca, Nath and Mehara, 1997). On the other hand, for each of the identified sources of synergy, we discuss its nature in order to support the subsequent of synergy evaluation.

Fig. 1: Conceptual scheme for identifying potential synergies in M&A deals (Payne, 1987)
3.1. Synergies Generated in the Procurement and Logistics Functions

The first class of synergies arising from the functions in question concerns the reduction of transaction costs generated by the upstream integration of production of one or more inputs. The choices of make or buy (Williamson, 1971; Perry, 1989; Grant, 1996) not only depend on the cost of buying the goods, but also on the costs of research and selection of the suppliers, the costs of negotiating contract terms, the costs of sending orders, controlling cost, the costs of the receipt of materials, the cost of controlling the quality of goods, administrative costs and, the costs of the settlement of payments.

Moreover, vertical integration can generate synergies in the supply of technological goods. Perry (1989) underscored that interdependence between phases of the supply chain can reduce the use of some production inputs.

In addition, synergies can be achieved as a stochastic increasing return in the management of raw materials. Unit costs of maintenance of raw materials, namely those generated by retention and storage of goods (financial charges, insurance charges, storage charges resulting from the risks, expenses and charges related to the additional space handling) are almost identical ex ante and ex post merger or acquisition. However, the optimal quantities of raw materials stored in warehouses to minimize the risk of running out of stock cost, in the case of homogeneity of raw materials between firms, it can be reduced for the effect of stochastic increasing returns (law of large number).

The last type of potential synergies related to procurement stem from the increase in bargaining power with suppliers. Often, the business combination reduces the number of buyers, raises the volume bought and, therefore, poses the basis for the reduction of procurement costs. The emergence of these synergies should not be taken for granted in every operation of M&A and for each supplier; in fact, it is important that we reach a critical size to gain significant bargaining power. We need to estimate the probability of obtaining favorable terms and the amount of benefits that suppliers may grant.

3.2. Synergies Generated in the Production Function

M&As can generate synergies related to increased efficiency thanks to the new dimension reached by the business combination. First of all, horizontal M&As - i.e., between firms operating in the same industry – may consent the rationalization of the production process, reaching a production capacity that is optimal given industry dynamics and technical aspects (such as the efficient use of establishments or the minimum efficient scale) (Capron, 1999).

A second class of potential synergies related to the production function includes all sources of economies of scale (Scherer, 1980; Gold, 1981; Hill, 1988). Achieving economies of scale plays a very important theoretical justification in M&As, because they generate strong differences in competitiveness between firms. Economies of scale arise when the return of the production function increases with the size of the production plant (Collis and Montgomery, 1997). The emergences of economies of scale imply a reduction of average unitary production costs when production increases (Lambrecht, 2004). Possible sources of the basic achievements of economies of scale (Zattoni, 2000) are:

a. the geometrical properties of some plants. Cash flows generated from this synergy are estimated with reasonable objectivity (i.e., flows on the basis of differential) by technicians and production engineers;

b. indivisibility of some inputs. M&As may help balance the production line. Bringing the flow of production to a level equal to the lowest common multiple of the capacity of each machine. The cash flows generated by this class of synergies are also simple to estimate for technicians and production engineers. In addition, when it is possible to dismiss one or more plants, it is appropriate to evaluate the flow of revenues resulting from their sale;

c. stochastic increasing returns in the management of stocks (finished and semi-finished). These synergies are due to the fact that, the amount of inventory with unforeseen needs is less than the sum of stocks that firms previously kept in their stores; and

d. similar considerations concern the reduction of reserve capacity for the case of an unpredicted increase of the number of customers served. In this case, the evaluation needs to take into account maintenance costs (operational and financial) of spare capacity multiplied by the reduction of spare capacity;

e. in theory, the synergies include the increase of the statistical regularity that allows a more efficient use of larger plants. Generally, however, this impact is unimportant.

The last class of synergies regards the scope
3.3. Synergies Generated in the Marketing Function

Firms may implement M&As in order to realize a strategy of market domination and to create new competitive conditions. Actually, M&A is an efficacy tool to rapidly expand market share in an industry. In this regard, however, it seems appropriate to underscore synergies related to reduction of competitive pressure are, taken on their own, often insufficient to make the operation of M&A profitable. In fact, Salant et al. (1983) showed that, in absence of other synergies, the horizontal merger between firms that use a game scheme à la Cournot is not profitable for the business combination, while it creates benefits for the remaining outside firms (the exceptions are cases in which M&A deals involve almost all firms originally active in the market).

The synergies resulting from the increased market power stem from:

- the possibility of raising prices; and
- the reduction of marketing costs due to the decrease in competition.

However, M&A deals are often intended as a tool to defend the competitive position achieved. In this case, the M&A aims to eliminate a firm, although it is not a direct competitor, in order to preempt it from launching an aggressive strategy in the future. In this case, the evaluation of synergies considers the differential increased cost in advertising or reduction in product prices under the hypothesis that the M&A had not been conducted.

When an M&A extends the business portfolio and the scope economies of marketing, these synergies can play an important role in determining the operations’ performance. The concept is very close to the above-mentioned economies of scale applied to the production function. Often, to ensure the development of the firm, it may need to add different categories of products to its portfolio, thus extending its product range. In this sense, M&A operations may represent a vehicle to grasp the strategic option of entering a related market and, simultaneously, exploiting the advantages of brand loyalty through brand extension. Obviously, these synergies are even more significant when the acquired firm is “anonymous,” but operationally sufficiently complete (Roedder and Loken, 1993). In addition to brand scope economies, brand extension strategies may enhance the brand equity of origin. Often this strategy clarifies, strengthens, or widens the scope of the brand of origin, increasing market coverage, and revitalizing the sales of the brand (Keller, 2003).

However, the extension of the brand into another market can have negative effects for two reasons. First, it may create confusion in consumer preferences. Second, products made by the acquired (or merged) firm may fail to satisfy a quality level traditionally connected to the brand. In such cases, the brand extension may generate a negative effect on the image of the parent brand (Reddy et al., 1994; Martinez and Pina, 2003; Zimmer and Bhat, 2004).

If the synergies emerging from process of brand extension are considered to derive from the M&As’ value, then it must be considered as an investment with a highly uncertain probability of effective realization. Conversely, if the effects of the brand extension are only a reduction in communication costs, synergies can be evaluated in terms of investment flows by considering their differential levels.

In addition, the marketing function can generate synergies in relation to the development of multiple brands. Multiple brand strategy allows companies to obtain more display space and greater negotiation power with distribution firm. These benefits should be carefully scrutinized, as excessive use of multiple brands sparking off a process of “cannibalization” between brands. In this case, the business combination dissipates its resources through a many-brand-sided development, rather than focusing on a few brands with high levels of profitability (Kotler, 1992).

Marketing synergies can also be connected to sharing retail networks. M&As may consent the access of new distribution channels (Mocciaro Li Destri and Minà, 2009, 2010), thus allowing to reach different customer segments, or overcome barriers to entry in certain markets.

Finally, synergies related to the marketing function may emerge from the rationalization of the marking workforce. These synergies are typical in M&As that aim to expand the geographic extension of the business portfolio. Divisions of the new business combination that overlap in one area, lead to the reduction of costs through the elimination of duplicate facilities and personnel redundancies.
3.4. Synergies Generated in the Organization Function

The integration of structures of the business combination should ensure a desirable level of both autonomy and coordination to the different divisions. It is necessary to make decisions about how to distribute authority positions within the renewed organization, redesigning new tasks and projects, including temporary teams. Human resource management will focus first on identifying workers who will remain part of the business combination and, eventually on new training. The organizational synergies amount to the savings cost generated by fining redundant. During the initial period, however, the net investment required for the preparation of organizational conditions for harmonization of technical aspects must be considered.

Dismissal policies need particular attention. The rationalization of corporate structures involves both workers at the lower and middle level of the organizational pyramid. In fact, sharing technical, administrative and support activities often implies making a part of the employees, redundant (or relocating them). Finally, restructuring human resources also involves middle and top management. Often, a significant part of them are excluded from new structures of corporate governance. The policies of worker’s dismissal are generate uncertainty and stress in human resources. Under these conditions, they tend to reduce their levels of activity and productivity.

Last but not least, we underscore that excessive growth in size leads to phenomena of free-riding: Each worker is potentially less controllable, and this might be an incentive to contribute less than required. In fact, when the span of control increases, there is the need to create several hierarchical levels that can however increase both the costs and the level of rigidity of the organizational structure.

3.5. Synergies Generated in the R&D Function

Before introducing the analysis of the synergies that may emerge in R&D function, it is useful to point out that although the operations of M&A are a tool to enhance the capacity to access patented innovations, the performance of this process does not constitute a synergy. Actually, the same value creation effect could be obtained simply by licensing patent (namely, accessing the knowledge patented through licenses).

The first class of synergies in the R&D function stems from reaching a size which is critical in order to join a network of firms, as complex dynamic systems of knowledge and capabilities (Dagnino et al., 2008), considered effective in terms of innovation. The importance of such relationships for the conquest and defense of competitive advantages is related to the integration of complementary skills between different firms (for instance, Saxenian, 1994; Powell et al., 1996; Basile, 2012). Synergies arise from the entrance in a network of real options with low exercise probability, the value of which depends on their contribution to the network in generating innovation, the probability of technological success, and the likelihood of commercial success. The actual realization of synergies related to entering a new network is largely uncertain. However, we underscore that information is the critical resource that generates strategic flexibility to recognize and capture project values hidden in dynamic uncertainties. Actually, since information is a critical resource in uncertain environments, the main benefit of entry into a new network through M&A deals is that it provides a platform for future strategies.

The second class of synergies in R&D - fairly common in M&A operations aimed at filling technology gaps - is achieved through learning and developing new technologies (Link, 1988; Capasso and Meglio, 2005; Graebner et al., 2010). Makri, Hitt and Lane (2010) find that similarities between firms in knowledge facilitate incremental renewal, while complementarities would make discontinuous strategic transformations more likely. Nonetheless, M&A may shape new capabilities by integrating existing and new resources that were previously unrelated; the phenomena tend to have a high impact when the M&A implements a related diversification strategy. In fact, according to Finkelstein and Halebian (2002), routines and practices developed in one firm transfer to other firms through business combination operations on the basis of the degree of similarity of industrial environments from which they proven. However, organizational learning thought M&A deals is extremely difficult (Barkema and Schijven, 2008; Hitt et al., 2009) vis-à-vis alliances (Dagnino et al., 2012).

This second class of synergies is typical of M&As between large firms and small firms, in which the big corporation has considerable commercial and productive resources focused on marginal innovations. Conversely, the small firm is really innovative. In this perspective, M&As may
play a role in reducing the time to generate an innovation and the appropriation of value from it (Mocciaro Li Destri and Dagnino, 2012)

The appreciation of the R&D synergies is extremely complex (especially in international M&A). In fact, the level of technological knowledge gained by the two firms separately results partly from the ability to absorb knowledge from outside and partly from internal R&D, so appreciation of the technological quality of synergies as the fundamental driver of value creation in M&A should be assessed in relationship to the possibility of recombination of knowledge and technology (Bresman et al., 1999).

Finally, a complex synergy to gain is the possibility that M&A deals can increase invention in new areas. M&As may foster the generation of future choices and potential for proprietary access to outcomes (McGrath et al., 2004). This hypothesis underscores that operating in distant markets increases a firm’s knowledge of its resources’ various possible utilizations, thereby generating new expansions possibilities. In this perspective, M&A deals are a way to create new possibilities for future efficiency. It supports the capacity to learn how to alter the resource configuration in adaptation to market changes. In this case, the uncertainties underlying the estimate of potential synergies increase significantly, making it crucial to use precautionary criteria of estimation. Precautionary criteria have also to consider that, generally, M&A have a positive effect on patenting output, but decrease patent impact, originality, and generality (Valentini, 2012).

3.6 Synergies Generated in the Financial Function

Since combinations of firms can improve the risk profile of business combinations, the finance function is a source of synergies in M&A deals. In an M&A context, the variables that reduce the level of risk connected to the firm are the larger size of the resulting corporation firm and, possibly, higher degree of diversification. Conversely, risk increases whenever operating and financial leverage ratios increase rendering the firm more rigid (Schweitzer et al., 1992). It is important to understand if reductions in the risk factors are offset (or more than offset) by increases in firm financial or operational rigidity.

Since a conglomerate’s corporate office can allow for a higher level of indebtedness (Lewellen, 1971; Picone, 2012) and advantages of deductibility interests, a lower cost of debt capital may emerge as result of M&A operation.

In the case of acquisitions, it is also important for the estimation of the WACC to consider a discount associated with the obstruction in the deliberative assemblies that minority shareholders could implement if they are excluded from any of the benefits available to majority shareholders.

4. THE NATURE OF SYNERGIES

In the preceding section, we identified the sources of synergies, using Porter’ value chain to map them function by function. Moving from these findings, we can classify potential synergies on the basis of their nature and, in particular, their mode of emergence. Following the classification illustrated above, there are three types of synergies:
- the value of incremental cash flow synergies that M&A deals generate ($S_t$);
- the value of the real options synergies that M&A deals generate ($S_o$); and
- the value determined by changes in the firms’ risk profile as a result of M&A ($S_R$).

Regarding the classification of synergies between differential flows or real options, we find a criterion in the distinction between tangible and intangible resources and the degree of innovation entailed by the integration process. The emergence of synergies from material resources, under the organizational and technological compatibility, through the generation of cash flow is relatively straight forward to assess. In contrast, the emergence of synergies regarding intangible resources can be highly uncertain. Accordingly, in the first case, the synergy benefits should be evaluated by discounting the cash flows at a rate whose level reflects the risk profile associated with the businesses combination. In the second case, it is better to refer to the option pricing models developed by modern financial theory, since they take into account the higher profile of uncertainty to which this type of synergies is subject. In this case, the “discounted cash flow approach in itself is insufficient and therefore, the options framework is a valuable tool-kit not only for analysts but also for the decision-makers in the top management of the firm” (Krishnamurti and Vishwanath, 2008: 139). Real option synergies underscore that an M&A deal may create economic value using the combination of scarce resources to undertake a potential opportunity in the environment (Andrews, 1971; Chatterjee, 1986). However, the evaluation of these synergies makes sense only if
in the future there the conditions for their realization exists or at least is likely to be fulfilled.

Finally, the synergies determined by changes in the corporations’ risk profile as a result of the M&A (SR) and computed according to the rules of finance should be considered in the definition of the WACC discount rate. This practice is consistent with the nature of SR (i.e. the risk of a quality variable); consequently, it is estimated indirectly.

### Table 1: Matrix of the main synergies

<table>
<thead>
<tr>
<th>Market power</th>
<th>Sharing tangible resources</th>
<th>Sharing intangible resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>- increased bargaining power toward suppliers</td>
<td>- rationalization of corporate structure (production and administration)</td>
<td>Low degree of innovation</td>
</tr>
<tr>
<td>- increased bargaining power toward commercial distribution</td>
<td>- reduction of vertical integration costs</td>
<td>- economies of scale for marketing function</td>
</tr>
<tr>
<td>- increased bargaining power toward customers</td>
<td>- technological economies</td>
<td>- streamlining the sales network</td>
</tr>
<tr>
<td></td>
<td>- reduction of inventories</td>
<td></td>
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<tr>
<td></td>
<td>- economies of plant</td>
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</tr>
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<td></td>
<td>- economies of scale</td>
<td></td>
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<tr>
<td></td>
<td>- economies of scope</td>
<td></td>
</tr>
</tbody>
</table>

\( S_F \)

\( S_F \)

\( S_O \)

### 5. A MODEL OF SYNERGIES ASSESSMENT IN M&A DEALS

The previous section offered a categorization of the sources of synergy and how to assess them. Obviously, the total value of the synergies in an M&A operation is the result of their sum. In particular, we have designed a method that considers jointly the DCF techniques - to measure SF and SR - and the Real Option technique - to evaluate SO. The two approaches of financial theory allow us to add values determined separately, because they share the same heuristic purpose, which is to summarize the potential value of the complex results from a combination of firms.

The methodology assumes the asset perspective, considering the WACC rate adjustment for the effects of debt (which we call WACC**). We justify this choice because of the need for agility, speed, and synthesis for the selection of the target firm.

In this section, we focus our attention on the addition of formula [7]. Indicates the change in value of total debt.

Simplistically, we can rewrite the [6] formula as:

\[
W_{AB} = (\overline{W}_A + \overline{W}_B) + (\overline{S}_F + \overline{S}_O + \overline{S}_R) - (D_A + D_B + \Delta D_{AB})
\]

### 5.1 Estimating the Incremental Cash Flows
The strategic plan of an M&A operation should explain how the resources and skills will be recombined to obtain market rents or economies in costs. We distinguish between post-acquisition synergies (or immediate), which are the result of the new asset allocation (for example, the sale of a plant unnecessarily duplicated as a result of the operation of M&A), synergies achievable within the time horizon of the plan, for which it is possible to elaborate analytical predictions; and potential synergies beyond the term of the plan. It is not possible to analytically estimate the better synergies; rather they can be estimated only on average.

The value of incremental cash flows may be calculated as follows:

\[
S_k = \sum_{i=1}^{k} \left[ \Delta(FCFO_{AB}) \right] \left( 1 + WACC^{**} \right)^i + \frac{\Delta(FCFO_{AB})(1 + WACC^{**})^{-1}}{WACC^{**}},
\]

where \( \Delta(FCFO_{AB}) \) indicates the differential operating cash flow of the businesses combination estimated analytically; \( \Delta(FCFO_{AB}) \) indicates the average differential operating cash flow of the businesses combination from the time \( t \) on; and WACC** represents the weighted average cost of capital of the businesses combination.

5.2 Estimating Real Options Synergies

As illustrated earlier, M&A operations may create value by enhancing the degree of fine flexibility and adaptability to external changes. Given the uncertainty connected to these synergies, the DCF evaluation method is inappropriate. However, real option theory is able to evaluate the business combinations’ capacity to “identify major changes in the external environment, quickly commit resources to new courses of action in response to those changes, and recognize and act promptly when it is time to halt or reverse existing resource commitments” (Shimizu and Hitt, 2004). Using the formula proposed by Black-Scholes model adjusted for dividends, the value of a real option is given by:

\[
O = Se^{-\frac{yT}{2}}N(d_1) - Ke^{-nT}N(d_2),
\]

where \( S \) is the present value of the potential development project; \( K \) is the initial investment necessary for the development of the project; \( R \) indicates the risk-free interest rate corresponding to the duration of the option; \( T \) is the time to expiration in years; \( Y \) indicates the instantaneous rate of dividend; and \( N(d_1) \) and \( N(d_2) \) are functions corresponding to the cumulative normal distribution to standard normal variables, respectively:

\[
d_1 = \frac{\ln \left( \frac{S}{K} \right) + (r - y + \frac{\sigma^2}{2})t}{\sigma \sqrt{t}}, \quad e^{d_2} = d_1 - \sigma \sqrt{t};
\]

where \( \sigma^2 \) is the variance of the natural logarithm of the value of the underlying asset.

It is important to stress that several problems may arise. The first is the difficulty of estimating all variables of the new investment and their capability to generate cash flow. Second, the evaluation of real options requires a cautious approach. The evaluation is justified by the possibility of creating sustainable competitive advantages in the long run. If the process of evaluation is repeated for all \( p \) flexibility options that the operation of M&A generates, we have the value of \( S_0 \).

\[
S_0 = \sum_{h=1}^{n} O_h = \sum_{h=1}^{n} \left[ Se^{\frac{-yT}{2}}N(d_1) - Ke^{-nT}N(d_2) \right]_h.
\]

5.3 Estimating the Synergies that Emerge from a Different Risk Profile

Finally, we must proceed to estimate the synergies that arise from the different risk profiles. We compare the value of firms under the assumption of unity of the economic entity (businesses combination) and the value of firms under situations of managerial independence (as before the extraordinary operation), i.e., standalone firms.
We can formalize the evaluation of synergies that emerge from a different risk profile as follows:

\[
\bar{S}_R = \sum_{i=1}^t \frac{(FCFO_{iA} + FCFO_{iB})}{(1 + WACC^{*})^i} + \frac{(FCFO_{A} + FCFO_{B})(1 + WACC^{*})^{-t}}{WACC^{*}} - D_A - D_B \\
\text{[11]}
\]

\[
- \sum_{i=1}^t \frac{(FCFO_{iA})}{(1 + WACC^{*})^i} + \frac{(FCFO_{A})(1 + WACC^{*})^{-i}}{WACC^{*}} - D_A \\
- \sum_{i=1}^t \frac{(FCFO_{iB})}{(1 + WACC^{*})^i} + \frac{(FCFO_{B})(1 + WACC^{*})^{-i}}{WACC^{*}} - D_B
\]

where FCFO_{iA}, FCFO_{iB} are respectively the operating cash flows of firm A and firm B in year i; FCFO_{A}, FCFO_{B} are respectively the average operating cash flow of the firm A and the firm B from t on; and D_A and D_B are the economic value of the debts of the firm A and of the firm B.

The WACC of A and B before the M&A transaction is adjusted on the basis of the procedure in order to keep the tax benefits of debt into account. Simplifying the above expression, we have:

\[
\bar{S}_R = \sum_{i=1}^t \frac{(FCFO_{iA} + FCFO_{iB})}{(1 + WACC^{*})^i} + \frac{(FCFO_{A} + FCFO_{B})(1 + WACC^{*})^{-t}}{WACC^{*}} \\
\text{[12]}
\]

Estimating the Total Value of Synergy (S_t)
To find a synthesis of all the expressions obtained, we proceed to combine [7], [8], [10] and [12]:

\[
S = \sum_{i=1}^t \left[ \frac{\Delta (FCFO_{iAB})}{(1 + WACC^{*})^i} \right] + \frac{\Delta (FCFO_{AB})(1 + WACC^{*})^{-t}}{WACC^{*}} + \\
\sum_{h=1}^p \left[ e^{-\gamma t}N(d_1) - Ke^{-\gamma t}N(d_2) \right]_h + \\
\sum_{i=1}^t \frac{(FCFO_{iA} + FCFO_{iB})}{(1 + WACC^{*})^i} + \frac{(FCFO_{A} + FCFO_{B})(1 + WACC^{*})^{-t}}{WACC^{*}} \\
- \sum_{i=1}^t \frac{(FCFO_{iA})}{(1 + WACC^{*})^i} + \frac{(FCFO_{A})(1 + WACC^{*})^{-i}}{WACC^{*}} + \\
- \sum_{i=1}^t \frac{(FCFO_{iB})}{(1 + WACC^{*})^i} + \frac{(FCFO_{B})(1 + WACC^{*})^{-i}}{WACC^{*}} - \Delta D_{AB}.
\text{[13]}
\]

From this formula, we derive the following compact formula:

\[
S = \sum_{i=1}^t \frac{(FCFO_{iAB})}{(1 + WACC^{*})^i} + \frac{(FCFO_{AB})(1 + WACC^{*})^{-t}}{WACC^{*}} + \\
- \sum_{i=1}^t \frac{(FCFO_{iA})}{(1 + WACC^{*})^i} + \frac{(FCFO_{A})(1 + WACC^{*})^{-i}}{WACC^{*}} + \\
- \sum_{i=1}^t \frac{(FCFO_{iB})}{(1 + WACC^{*})^i} + \frac{(FCFO_{B})(1 + WACC^{*})^{-i}}{WACC^{*}} + \\
\sum_{h=1}^p \left[ e^{-\gamma t}N(d_1) - Ke^{-\gamma t}N(d_2) \right]_h - \Delta D_{AB}.
\text{[14]}
\]
6. CONCLUSIONS

This paper offers a systematic analysis of the sources of the synergies that can emerge in a M&A deal, “mapping” function by function and categorizing the synergies on the basis of their emergence. Moving from the idea that, if the strategy is unclear, there is no reason for a firm to make on M&A deal (Bower, 2001), this analysis provides the fundamentals for the subsequent development of a methodology for estimating different classes of synergies. We make clear the hidden potential of a generic M&A. A proper assessment of options for external growth is not possible without appreciating strategic and organizational aspects on the basis of the estimation of the differential cash flows related to synergies, the impact of M&A on the risk profile of businesses combination and, finally, without taking into due consideration the options that the operation of M&A can generate in terms of operational and strategic flexibility. The extent of synergies not included in traditional evaluation formula is therefore an issue that bridges the gap between strategy and finance, as it requires a unified view of phenomena and key operational processes found in M&A.

The benefits related to a methodology of assessment of synergies in M&A transactions are numerous, and extend far beyond the proper definition of the price fixed through negotiation between the parties. In particular, these additional benefits include:

- a template to support the selection of the target firm (Mitchell and Shaver, 2003). The measure of potential synergies allows us to compare different candidate firms. Thus, the evaluation model proposed may support management decision-making (Cobblah et al., 2010);

- a support for the processes of planning and management of the integration between the firms (Zollo and Singh, 2004; Schweiger and Lipper, 2005; Dagnino and Pisano, 2008; Teerikangas et al., 2011) since the value of synergies becomes a “strategic goal” and, hence, the instrument to guide the process of integration between the firms; and

- the definition of a premium of acquisition consistent with the value of potential synergies, the payment of the premium (Chang, 1998), and the management of the financial structure (Lewellen et al., 1995; Maloney et al., 1993) of the corporations as a result of the M&A.

This paper gives no specific solutions to a limited number of aspects of the proposed methodology for the estimation of synergies, which may represent areas of interest for further research on the topic. More research needs to be done to examine on methods - qualitative and quantitative information – to accurate the estimation of the unlevered cost of equity of the combining firms. In this perspective, we recall also the need to develop rigorous algorithms for correction of the rate to discount cash flows to consider tax benefits, the costs of (so-called) financial stress, and control costs.

Finally, the applicability of financial options techniques asks new investigations on applicable principles of option pricing theory in real contexts. While Black-Scholes’ formula is appropriate to assess the value of a financial investments, the application of Black-Scholes’ formula in real context violates some theoretical assumptions, e.g. the lognormal distribution of the project values. On the other hand, empirical estimation of the inputs in Black-Scholes’ formula is really complex, for example the volatility is not easy to estimate.

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