The Value of Synergies through the Real Options Lenses

The Case of DaimlerChrysler: could failure have been predicted?

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EXECUTIVE SUMMARY

This thesis uses concepts from the field of strategic management to motivate the potential behind the use of real option (RO) for the valuation of synergies, in the context of a merger or acquisition. The discount cash flow (DCF) model, vastly utilized by practitioners, has been argued to not fully grasp all the variables and factors underlying the uncertain, irreversible investments a company can embark on. If synergies are seen as investments, and as real options given the uncertainty, irreversibility and managerial discretion surrounding them, then real options valuation (ROV) seems to be a more suitable tool to come to a final more likely value of their realization.

Initially, a general introduction about M&As is made, and a particular attention is given to the elements leading to failures in such a context. Here, the wrong valuation of synergies and a too optimistic view of their materialization represents one of the most significant pitfalls in the decision process, and can therefore lead to a failure. Since synergies are proven to be uncertain, not only in their actual materialization, but also in the value they are going to transfer to shareholders, the DCF approach is definitely too simplistic for this goal. On the contrary, RO seem to have the same characteristics as synergies, i.e. uncertainty, irreversibility, and managerial discretion surrounding their exploitation. Consequently it is argued that the ROV method can be applied to those synergies that have the right characteristics. Through these lenses the value of a target company can be divided into three elements, namely the value of the assets in place, the target’s RO, and finally the value added given by the out-of-the-money RO the target holds, that can be turned into in-the-money RO through the acquirer’s resources.

Lastly, a valuation of the synergies from an M&A failure is made. The deal chosen is that of DaimlerChrysler, signed in 1998. First, it is assumed that the stand alone value of the target has been estimated correctly at the time. Secondly, as the Datar-Mathews method for ROV requires, the incremental value of synergies in three different scenarios is calculated. Third, a Monte Carlo simulation is performed, and the value of the free cash flows from synergies calculated for every trial. This measure includes the integration costs needed to increase the likelihood of synergies realization. The RO value, i.e. the value of synergies, is then calculated for each of Chrysler’s shares, namely $2.83 per share.

In conclusion, this thesis shows how ROV can be a valid addition to the DCF when calculating the value of synergies.
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1 Introduction

1.1 Background

Each year, tens of thousands of mergers and acquisitions (M&As) totaling in excess of $2 trillion are carried out (Cools et al. 2007). This makes M&A activity an important element of a functional and dynamic economy. In the modern economy, firms can easily find counterparts to join their efforts with, in an attempt to restructure their assets and overcome economic obstacles. Mergers and acquisitions do not only impact the companies involved, but also the broader economic environment as competitors face a new, and more consolidated, competitive situation and consumers potentially face a new service offering.

Whether or not M&As create value though has been a hot topic for long, especially after the waves of merger activity recorded in the past decades. Furthermore, increasing attention is paid to whom the transaction is creating value for. The parties involved in a transaction are the acquirer and the target firm, i.e. the acquired one. Most shareholders will agree that the chief goal of a corporation is to create value for its shareholders. Therefore, in the context of mergers and acquisitions, the acquirer’s shareholders will be expecting the transaction to deliver synergies over and above the premium paid, while the target’s shareholders should expect a premium paid for their shares in the target over and above the market value of their shares.

Much research has been conducted on the merits of mergers and acquisitions, and evidence is uncertain. On one hand, it has been shown that on average, acquisitions collectively create value for both the acquirer’s and acquired companies. A study by McKinsey, which analyzed 1415 acquisitions between 1997 and 2009, has shown that the combined value for the two companies involved in the deal increased on average by 4% (Rehm, and Siversten, 2010). However, others have proven that on average, mergers and acquisitions create value only for the acquired company’s shareholders, since acquirers underperform comparable companies on shareholder returns by 5% during the three years following the acquisitions (Mitchell, and Stafford, 2000).

While M&As can create value for acquirers and targets, a commonly held conviction is that some 70% of M&A deals fail (Christensen, 2011). A failure in this regard is a deal that does not meet the expectations of return on invested capital, and according to Christensen,
failures arise independently of how much money and resources the acquirer commits to spending when signing the deal.

1.2 Problem Outline

Given that so many deals turn out to be failures, the focus should be on how companies decide whether or not to acquire another company. This is even more relevant, given the resources required in planning, agreeing on, and executing the M&A that the firms involved in these transactions commit to the deal.

Within the field of M&As, it is said that 1+1=3, rather than 2. This is because the combination of two entities is supposed to lead to something bigger than the simple sum of all the elements on their balance sheets and income statements. Synergies account for the value over and above the combined value of the entities. These are essentially the economies that the joint entity is able to achieve, thanks to the exclusive combination of complementary resources and capabilities of the two or more firms involved. Given this overview it is then possible to define synergies as value added, and therefore value creation through synergy realization.

If companies decide to proceed with M&As based on the value they can forecast to generate from them, it means that the way the value of synergies is quantified assumes great relevance in this context. More precisely, if management believes it will be able to achieve these synergies, it will proceed with the transaction, but not if the opposite is true. It is then worth taking into consideration how this value is calculated and what the relevant variables are, and this is exactly what this thesis focuses on.

This paper will attempt to fill a dual research gap. On one side, many researchers have focused on the shortcomings of the DCF method, which is the method generally used for the valuation of a target and the calculation of the value of synergies (Chong, and Philips, 2012). There is also the issue of synergy creation, and how to best value synergies. Inherent in the DCF method is a lack of flexibility and full adaptability to uncertainty, which are some of the elements that characterize synergies, and their materialization. Thus, if synergies are valued using a DCF approach, it is unlikely to serve as a solid foundation for a sound and successful acquisition decision. Thus, further research on how to properly value them in order to take uncertainty and volatility into the equation is absolutely necessary.
When estimating the value of synergies, the management of a company can be biased in many ways. Empire building, hubris, and many other behaviors come into place when significant potential gains are at stake, and the potential risks are huge, but can be shifted onto others. Often, the downsides of a merger or acquisition are neglected, as people tend to be overoptimistic in these situations. If the value attributed to synergies is so important in the decision process, a more objective appraisal than managers’ over optimism should be employed as shareholders are the ones ultimately paying the price, but are not involved in the valuation- or decision process.

Synergies are inherently uncertain, both in their realization and in their materialization value; they are irreversible, as once the deal has been approved and actions for their realization put into place, it is very time and resource consuming to go back to the previous situation; finally their planning and realization depend on managerial discretion, and are therefore dependent on management’s decisions. The value of synergies is usually determined by discounting the value of the incremental cash flows back to time 0. However, this method is static and does not incorporate the possibility that the cash flows deviate from the forecasts, and does not take into consideration the elements characterizing synergies discussed above.

An approach that reflects the nature of synergies instead is that of Real Options (RO). These are often used in the context of projects and investments. They assume particular relevance when the investment can be staged, based on how circumstances change. This is essentially what happens within and M&A deal: once the acquirer buys the target and the transaction is complete, its management can then decide on how to stage the different investments needed in order for the synergies to materialize. A considerate management team will analyze circumstances carefully and take decisions based on them. The upside of incorporating such a method for the valuation of synergies before the deal is the fact that it gives management a tool to include uncertainty in the valuation. To conclude, the value of synergies changes continually, and it is difficult to predict in which direction. Therefore, all possible ways they could evolve need to be taken into account, in order to have a more accurate and precise overview. With regards to this, figure 1.1 shows how CEOs have
answered to a study by KMPG, when asked if the value of synergies changed compared to forecasts, and when (KPMG, 2010).

**Figure 1.1 - Changes to the synergies estimates.**

![Figure 1.1 - Changes to the synergies estimates.](image)

### 1.3 Problem Statement

The purpose of this thesis is to fill the dual research gap explained above. This will be done in two different, but connected steps. First, the literature on the topic will be analyzed, and the potential solution addressed from an academic point of view. A new method will be identified and its validity for the purpose discussed. Second, the abilities of this method will be examined empirically in a case study. The research question that is going to be addressed throughout this thesis is then:

**Are real options a better tool than current practices for valuating the synergies stemming from an M&A deal? By reflecting more information, are they capable of better leading managers when it comes to deciding whether or not to proceed with a transaction, and therefore avoid failure beforehand, by not undertaking the project at all?**

In order to fully fill this gap, a number of sub-questions will be answered:

- How are synergies relevant?
- Which specific characteristics do they require in a valuation model and why?
- What is wrong with the current practice, and how does Real Options Valuation (ROV) help in these circumstances?
- How can the value of a target firm be broken into different parts through these lenses?
What is the value of synergies alone identified through ROV?
Would the decision be the same as that taken through a plain DCF valuation?

1.4 Methodology

The approach adopted in this thesis is a deductive approach. It focuses on developing one or more hypotheses based on the existing theory, and then designing a research strategy to test those hypotheses (Wilson, 2010). Despite the fact that there is no formalization of any hypotheses in this thesis the method used is the same.

Drawing upon the different concepts and theories exposed in the first sections of the paper, the research gap is addressed, and a possible solution is given not only on a theoretical basis, with the introduction of the ROV, but also on a more practical basis, when the case is discussed. On top of that, reasoning from the particular to the general, the specific match between ROV and synergy valuation found in the case analyzed below, and the conclusions made from it, can be generalized to the broader case of M&A transactions, as implied by such a methodological approach (Gulati, 2009). As such, this step is inductive.

A more strategic and less biased method is proposed for the pre-deal synergies identification and valuation. The financial concepts utilized for the valuation are therefore analyzed in the light of the corporate strategy concepts driving M&As. In doing this, the analysis is based on objective data, so that the research could be carried out in an objective manner. The only sections that are slightly more subjective are those concerning the strategic aspects of the case. Here, an external foundation is drawn upon, but the interpretation of this information at hand is at the discretion of the author.

In an attempt to generalize the specific circumstances of synergy valuation through the ROV approach, a real case has been chosen. This has been selected in order to underline the relevance of the concepts exposed in the previous parts of the thesis. The case chosen is the merger of Daimler-Benz and Chrysler, which took place in 1998. While the specific reasons backing the choice of the deal and the industry will be explained in the dedicated sections, it is important to point out here that it was necessary to choose a merger that failed, in order to fill the outlined research gap. This will be done by verifying whether or not RO, by incorporating the specific aspects characterizing synergies represent a better tool in valuing them compared to the most common methods used by practitioners. Consequently, in order
to define which method better addresses synergies, it is necessary to see if a decision taken from a ROV would have been different, and therefore if a significant waste of money and resources could have been avoided. This means that, in the case of a transaction that failed, if ROV is preferable to DCF then it should better predict the real odds of succeeding in such a deal, leading to a lower value of synergies as opposed to the DCF originally applied. This should then lead the management to take a different course of action. If such an extreme decision could not be taken confidently, then the newly proposed method should at least make management understand the risks of proceeding. By choosing a failure then, the difference in value between ROV and DCF can be seen more clearly.

In order to prove the validity of the results and their significance, the analysis of the case has been based only on public information, and only on the information that could be retrieved at the time of the announcement. In this way, it is granted that the managers who made the decision at the time could have come to the same conclusions as the ones presented in the thesis, if the same approach had been used. The only information post-merger used is that reported in the section referring how the merger really turned out.

Finally, since the length of the thesis is limited, the focus was restricted to those elements of particular relevance in addressing the research question and filling the research gap. As a consequence, the valuation of the target firm as a stand-alone company, the basis for every target valuation, has not been carried out. It was instead assumed that market capitalization is sufficient for that. The focus is limited to synergies valuation, therefore only the incremental value generated by them as RO is calculated.

2 Mergers and Acquisitions

2.1 Long Story Short

During the years an increasingly bigger number of M&A deals have occurred. Not only the absolute number of transactions has increased, but the volume of each transaction has risen as well (Cools et al., 2007). M&As have always materialized in cyclical waves, as a sequence of high intensity periods, and low intensity ones. It is essentially possible to distinguish six different peaks of activity, each of which corresponds to a certain trend in the M&A world. A more immediate representation of these waves is given in figure 2.1.
Another trend that is worth of notice in this development is the fact that Private Equity Funds have assumed a bigger role in the wave of consolidation that characterized the years between 2002 and 2007 (Cools et al., 2007). It also seems that we are in the middle of a new wave (The Economist, 2010; Mergermarket, 2014), which is instead characterized by the fact that a lot of the deals are paid through cash. It seems this surge started again in 2010, a period of relative lack of confidence, which goes surprisingly against every prediction when it comes to motives for acquisitions.

2.2 A Broad Classification

Before digging into the topic, it is relevant to first define what is meant by M&As, and how these deals work. The expression mergers and acquisitions refers to a broad range of practices through which a firm can restructure its assets, by incorporating those of another company (Pangarkar, 2000).

It is possible to classify these different uses, depending on how the different entities involved are planning to integrate themselves. Specifically, I will distinguish between two big categories: one represented by the situations in which a company is acquired by another firm, and the other one in which the firm is simply bought by its management and (not necessarily) outside investors (Damodaran, 2001).
To the first category pertains the broad group of mergers. They imply that, after the boards of directors of the two companies agree to merge together, the target firm becomes an integrated part of the acquirer, while the former as it was known before completely disappears. Consolidations are part of the same category as well. As a matter of fact, through this process the parties agree to create a brand new company, whose shares are given to the stockholders of the consolidating firms, according to the amount they were holding before the decision. A tender offer instead takes place when a potential acquirer invites all the stockholders of a target firm to sell him their holdings at a specified price. The target firm will be then bought by the tender and will be owned by it, but only in the percentage corresponding to the amount of shares the latter actually bought. Finally, an acquirer can also buy a target, take the latter’s assets in order to transfer them to the acquirer’s company, and finally liquidate the target.

As far as the situation in which the management of a company buys it instead, here there is only one possible outcome, a buyout. In this case the target firm keeps existing, but as a private entity rather than a public one.

In this paper, a more general acceptation will be used. Specifically the terms M&A, merger or acquisition will simply indicate a transaction through which two or more companies combine their assets. The two terms will be used interchangeably, apart in specific cases, where referring to an actual deal. In that case the specific kind of transaction involved will be mentioned.

Despite the different typologies of acquisitions, they all require the same main steps. First of all, the acquiring firm needs to establish a motive for the acquisition, then a target must be chosen, and it has to be valued, keeping the acquisition motive into consideration. Finally the mode of payment is decided (e.g. stock or cash). Finally, post-deal integration is also a very relevant step, whose wrong implementation undermines the basis for each transaction. Despite the importance of every single one of these steps, I will focus my efforts on the valuation of the target firm. Specifically, as the research question of this paper pertains the valuation of synergies, the biggest effort will be made within those boundaries.
2.3 The M&A’s Clockwork: How Do These Deals Work?

Before looking at the main reasons firms usually engage in M&A activity, it is worth looking at the way the price a bidder is willing to pay for a target is actually determined. The following description is the one generally used by practitioners, but a slightly different version will be introduced in one of the next sessions, in order to better match and explain the research question. By looking at figure 2.2, it is possible to identify a few different elements. The starting point is the book value of equity of the target firm. This is essentially the value of the firm as resulting in the balance sheet, i.e. the difference between assets and liabilities. The market value of the firm instead can be calculated by simply multiplying the price per share by the number of shares outstanding. It does not necessarily reflect the value of equity. Actually, it will more often happen that the former is either lower or higher. In the first case, the market values the company for less than its books actually record. That means that investors have lost confidence in the fact that the company in question will eventually be able to generate cash flows through its assets. In the opposite case instead, the firm is predicted to grow faster and to be more profitable, and these positive forecasts are reflected in this difference (Cohen et al., 2003). If the M&A is believed to be able to create value for the bidding firm, then its management will be willing to pay a little extra in order to make sure to get the deal. This element is called the acquisition premium. The sum of market price and premium represents the acquisition price for the target firm, and what its shareholders are going to receive if the deal is approved. In the moment the transaction takes place, goodwill must be recorded in the accounting books as well. This represents essentially the difference between the acquisition

![Figure 2.2 - Components of the Acquisition Price of a Target.](image-url)
price and the actual book value of the target, and it is regarded as an intangible asset, whose value needs to be assessed every year.

As the element of biggest interest in this thesis is the valuation of synergies, the focus in the following section of the paper will shift to the acquisition premium, and to the reasons brought up in order to justify it.

2.4 Why Do They Do That?

Whatever the form of acquisition, this process is always supported by a motive that the acquiring firm values important enough to proceed and that eventually justifies the acquisition premium. Apparently these motives are so strongly believed in, that firms still pursue this kind of activities although their failure rate is calculated to be somewhere between 70% and 90% (Christensen, 2011).

The reasons why companies engage in such transactions are infinite, but it is sometimes useful and helpful to distinguish some main categories among them. A very simple and common rationale behind these deals is undervaluation. Many academics focused on this element, stating that the likelihood of a firm being targeted increases the more it is perceived as undervalued (Gonzalez and Kish, 1998; Steiner, 1985; Ravenscraft and Scherer, 1987). It is absolutely straightforward that when a company's price on the market and its market value is lower than the real value of the company itself, then it is possible to exploit the situation by buying it. This motive lies on the basic assumption that a firm that is targeting another one has more information about it than the company itself, and the broader market in general. It could be for instance that the bidder is sure some benefits could be gained through the unique combination of its assets with the target’s ones, benefits that can be achieved both on an operational or a financial level. On the other side instead, the former could be aware of the positive returns coming by the abandonment of a business unit of the acquired-to-be firm, etc. (Trautwein, 1990).

The so-called monopoly theory is an M&A motive as well. It postulates that the reason why a company decides to combine its assets with another comes from the possibility to gain a much bigger share of the market. Of course this purpose seems to be more relevant in industries where investments in big infrastructures are needed. This is because barriers of entry are bigger in such a situation, and only a few players can actually compete in such a
market. A big transaction that was carried out for this reason is for example the one that led to the formation of U.S. Steel, that became the first billion-dollar corporation in American history and was born specifically with the intent of becoming the market leader in the industry (Reback, 2007).

Acquisitions can also be, for example, driven by agency costs (Trautwein, 1990; Hitt et al., 2009). These transactions are meant to increase the size of companies by putting the assets of different firms together. The size of a company is usually positively correlated with the salary of the management of that company, which can be often moved by “agency feeling”, leading it to put its own interests before those of the shareholders. This is the reason why some of them push for acquisitions to happen, but it is easy to understand how this phenomenon, that takes the name of empire building, is deemed to generate failures as it is not based on the right premises.

2.4.1 The Synergy Effect

The primary motivation for M&As though is efficiency gains, which materialize in the so-called synergies (Mukherjee et al., 2004). If we look at the literal meaning of the word, it comes from the Greek “syn”, together, and “ergein”, which translates into work. It is easy to understand then that this concept refers to the idea of working together.

More specifically, synergies are the benefits two firms achieve by combining their resources, rather than by continuing to carry out their businesses by themselves. This idea is usually expressed through the following equation:

\[ V(AB) > V(A) + V(B) \]

where

- \( V(A) = \text{Value of firm A, when working independently} \)
- \( V(B) = \text{Value of firm B, when working independently} \)
- \( V(AB) = \text{Value of firm obtained by combining the two independent firms A and B} \)

Synergies can be divided into two big categories, depending on which level they benefit the firms. These are operational synergies and financial synergies.

Operational synergies can be broken down into two further groups, distinction that is especially useful when actually coming down to the valuation of these combined benefits.
There are cost synergies, which will increase the company's cash flow as a consequence of a reduction in the cost-base; and there are growth synergies, that stem from several sources. At least three types of these synergies can be identified (Damodaran, 2005):

- Higher return on investments
- Broader pool of investments to choose from, which bring to a higher investment rate and consequently a higher growth rate
- Potential to maintain growth for a longer period, coming from the stronger position the new entity is in after the transaction.

A first example of the benefits coming from cost synergies is given by economies of scale and scope. By increasing the production and sharing resources among the different units, the improvements in efficiency can be substantial. The combination of different functional strengths can open new frontiers to companies putting their efforts together, justifying a higher value for the combined firm. It is enough to imagine a company that has a very good product, but a not very efficient sales force. If merged with another that possesses the complementary capabilities, the gains would be immediate. The same thing might happen in a slightly different context, as M&As give firms the possibility of pursuing higher growth in new or existing markets. A new kind of economies is included in this synergy category. It is the so-called economies of skill, that allow firms to share as well as build best practices in an easier manner, helping them improve their performance and capabilities (Malani et al., 2013). It has also been argued by many that these transactions are a way firms can access faster and in an easier way to innovation, which is especially true in industries where technological advances are on the agenda (King et al., 2008; Uhlenbruck et al., 2006).

Greater pricing power can come from operational synergies as well: by acquiring a company, especially in a horizontal merger. In this contingency the combined firms used to work in the same industry, therefore by becoming one entity, they increase their market coverage, which gives the new firm broader power. This element is on the same line as the monopoly theory as a motive for M&As, cause it grants the company in this situation to take advantage of its position of strength.

Summing up, operating synergies materialize in production or administrative efficiencies (Chatterjee, 1986), by increasing the company's operating income, growth or both.
The other big group of synergies is that of financial synergies. These essentially allow the firm to lower its financial burden, either by granting it higher cash flows, or by lowering its cost of capital. They have gained more relevance in the last years, as a consequence of the financial crisis. Companies are more and more worried about avoiding finding themselves into financial distress, and therefore they put particular focus on these issues (JP Morgan, 2009).

When this kind of synergies exists, the company structure resulting from the transaction can usually count on a more secure financial situation, which is a consequence of the higher stability reached combining the assets of the two pre-transaction firms. This usually means first of all higher cash flows from the business, because of the newly joint operations. Operational synergies can also account for part of this increase, at least for the starting point of increased income. Second of all, the greater certainty granted by the improved cash flows is the fundamental basis for a lower cost of debt.

Not only that, but cost of capital can be lowered as well as a result of a reduction in cost of equity. This is particularly true if the firm impacted by the merger is in a merger-intense industry. As a matter of fact it has been argued that the cost of equity is negatively correlated with the intensity of the merger activities in the industry (Mamun, and Mishra, 2012). This comes from the fact that greater media coverage and a bigger amount of analysts and investors following a firm in such an industry are likely to notably reduce information symmetries. Investors in the firm will be then more willing to accept a lower return on their equity, because more aware of what is actually happening within and to the firm.

Finally, financial synergies also include tax benefits. The tax shield actually becomes more likely to be realized since the taxable income of the combined company is bigger. This, together with the reduced risk of default of the new entity mentioned above, makes the tax shield increase even further in value.

3 Entrepreneurial Failure in M&As

Mergers and Acquisitions are essentially a gamble: the success rate has been predicted to be 50%. This means that, when engaging in such a transaction, we have the same probability of succeeding as that of getting a head when tossing a coin. When the CEO of a firm decides
to merge its company with another, he does not expect that the deal he is proposing has all the potential to be a failure, therefore he proceeds anyway. As a matter of fact, many studies have found that “corporate mergers have even higher failure rates than the liaisons of Hollywood stars” (The Economist, 2000).

3.1 M&A Failure: The Basics

Before going further on such a topic, it is relevant for the scope of this paper to define what I mean with “M&A failure”. In order to do that, I believe a digression on the value creation linked to mergers needs to be made.

3.1.1 Value Creation and Synergies

I will focus on the word “value” by itself first. Specifically, there are many opinions about what the goal of a firm is, and creating value is definitely something most scholars agree on (Jensen, 2001). In one of his most popular papers, Jensen (2001) discusses whether or not a firm should have more than one objective, and then what this objective(s) is. As far as the first point is concerned, he argues that the objective for a company must be one and one only. This is because it is not possible for management to pursue more than one goal at a time, without missing something in at least one of them. The only option available at this point is then to specify the tradeoffs between the various dimensions usually identified as objectives (e.g. maximize current profits, reduce cost-base, establish relevant growth in profits, etc.) and use them as variables of a bigger objective function, whose achievement depends on all the decisions taken concerning these dimensions.

As far as the ultimate objective of the firm is concerned instead, he continues, that is to maximize the firm’s total value. Not only this is good for the company itself, but it is also good for society in general. This is true, according to the author, because society is better off when it perceives it gets something more valuable out of the inputs it contributed with in the first place. This is exactly what happens when a firm produces an output within society, which is seen by it as more valuable than the inputs alone.

It can be argued that in a situation such as an acquisition, value is created when the new entity is worth more than the sum of the value of the two entities involved in the transactions working independently (Seth, 1990). This is exactly what synergies are about,
therefore we can conclude that saying an acquisition created value is exactly the same as saying the deal realized the synergies forecasted. This equivalence relation will be carried out throughout the entire paper, and the expressions will be used interchangeably.

Another issue worth a brief mention is that of the end beneficiaries of the value that is being created. It is common opinion that the company should be managed in the interests of shareholders. While these agents put their money in the firm and therefore own it, they are not the ones managing it though. This is due essentially to the difficulty of making things right when a company is managed by too many people (investors holding participations in a company’s stock are generally many). This situation leads to the separation of ownership and control (Fama and Jensen, 1983), in which the one taking care of the business’ the day-to-day operations is the management board. Often managers do not prioritize shareholders’ interests though, but their own. This is exactly what leads many of them to propose unstable and unlikely-to-succeed M&A deals, in an attempt to increase their personal return. The empire building behavior has been mentioned above already as a motive for these transactions. This bond is what is typically called a principal-agent relationship, where the stockholders are the principals, and the managers are the agents acting on their behalf. This leads to the problem that, when acting in this opportunistic way, managers put the owners’ money at risk, taking all the benefits coming from a contingent success for themselves.

These agency problems will not be the focus in this paper though, and their discussion will be limited to this with no further analysis of the issue being executed.

3.2 Deals meet real life

The first thing taught in finance class, whenever acquisitions are mentioned, is that the acquirer’s stock price reacts negatively to the transaction announcement and immediately drops. This event is often simply an anticipation of what will happen soon after the deal is closed, as the operations of the merged entity will not always turn out to be as rosy as initially forecasted (Sirower, 2006).

What is it though, that gives the market a reason to expect lower returns so early in the process already? First of all, despite the potential benefits coming from an acquisition, it still requires the bidder to spend a large amount of resources in advance, whatever the form of the financing of the transaction is, i.e. either cash, stock or a mix. Second of all, the synergies
that are always postulated as certain do not come for free. Huge investments are needed for those, and it is not only financial investments that need to be made. Integration, whether cultural, organizational, on an accounting level, etc., is always difficult to achieve, and requires big efforts investors are aware of. This leads them to lowering the possibilities of success for an acquisition that is especially based on frivolous motives. These issues will be further developed in the next sessions though.

Finally, it might also be that all the efforts put into integrating the two companies and make the synergies work, actually distract the new entity from competition. This affects the latter especially because of the fact that competitors will not stay there and look while the transaction takes place, but will most likely react to it instead. Firms should therefore apply the 80/20 rule, which means taking care of 80% of the transaction in 20% of the time (Camara, and Renjen, 2004).

3.2.1 Mergers & Acquisitions’ Achilles’ Heels

It seems then that investors already have a bad feeling as soon as the deal is announced. And it seems that they are right. As it has been said, the failure rate for M&As is predicted to be between 70 to 90% (Christensen, 2011). In absolute terms, consider that in 2013 the total amount of these transactions in the United States was 9552 (Statista.com), it is possible to conclude that, on average, 6680 of those deals are going to fail, if they have not done that yet.

If we look at real life cases, it is possible to distinguish some recurring elements in mergers and acquisitions that are worth talking about a little before proceeding. According to Very (2004), it is possible to identify some apparent motives for failure in such transactions. This happens for example, when the price paid is too high, or individual reactions are too difficult to manage. In the latter case he refers to the fact that companies are made of people, and it is often because of a couple of special people that firms achieve their goals and perform well. As a consequence, a motive of a merger fiasco could be the unpredictable situation when these people actually leave the company.
Another reason can be collective resistance from both the employees of the target, and those of the bidder. The former case is more typical of a hostile takeover, but the latter is actually possible in any case, cause it is not always so easy to make everybody agree on something in M&As as well. External events and skeletons in the closet, i.e. things the bidder did not know about the target before actually working together, are other two apparent reasons. The author argues though that you can actually go deeper in the analysis, and you will actually find the causes of the issues in managing the acquisition process, which is the ultimate reason why all these apparent problems showed up. The first element among these reasons in what is actually at stake: many resources need to be mobilized, both before and (most of all) after the deal has been completed. All information cannot be known in advance either, and with that Very does not only refers to the information about the target itself, but also the information that stands at the base of the motivation of the takeover. The structure of the process needs to be carried out very precisely and thoroughly, since it is difficult to reverse the actions included in these transactions. This situation gets even worse when there is time pressure, element that you need to consider especially in fast moving industries, where competition is always ready to strike. Last, but not least, employees represent a fundamental mechanism in order to make these deals work. They are the ones that carry out daily operations, and the ones that will be working together and make the new engine create the value it is supposed to create.

Figure 3.1 - M&A Failure Apparent and Real Causes.
All these elements can be seen, together with their interactions, in figure 3.1. They ultimately show how difficult and unpredictable it is for companies to materialize synergies, and this shows the importance a correct integration of these elements has in the valuation process.

3.3 The Synergy Trap

Synergies are the first tangible outcome companies can see after an acquisition. What is good about them is essentially that they imply both companies are better off somehow: the target receives an acquisition premium, while the buyer materializes shareholder value, and therefore pursues its main objective, by realizing synergies that exceed what has been paid for the acquisition itself.

In order to make a deeper and more complete analysis of where current practice and real life transactions are heading, I am going to organize the discussion around three different points:

- Make a digression on the most current opinions about synergies;
- Talk about the empirical evidence about them and their realization;
- Further deepen the discussion and investigate the implications for this paper.

3.3.1 What do people think?

During the years many scholars have been discussing the role of synergies in acquisitions and whether or not they are a valid motive for them.

Not everybody agrees on the fact synergies only create value and have positive externalities on the businesses involved. Specifically, Shaver (2006) distinguishes two phenomena that stem from the fusion of two companies and have negative consequences on them. On one side, when their assets are combined, the two businesses necessarily become more interdependent. This means that if one is affected by negative shocks, the other one endures them as well. The author calls it contagion effect. On the other side instead, the two entities suffer from a capacity effect as well. It comes from the fact that through their integration, companies often cause a reduction in slack resources. This happens as a consequence of the increase of the capacity utilization of the underlying resources owned by the two entities. Synergies are always accompanied by these two phenomena.
The elements just mentioned bring very important consequences to the overall opinion about synergies and the concept of value creation in mergers and acquisitions. First of all, the existence of contagion effects means that, independently from how well planned and organized a merger is, value destruction is always a potential result. Further, this effect is even bigger in transactions that take place within industries and between firms that are at the first stages of their development: the higher the uncertainty, the worse the consequences. Finally, the presence of contagion effects can also move the attention in terms of M&A failure from a poor choice of target or poor implementation to different reasons.

It has been tested that despite the measure of performance or the typology of acquisition (i.e. related or unrelated), M&As create value (Seth, 1990). Further, I started the paper by stating that I would consider value creation and realization of synergies as synonyms. If that is true, it can be concluded that the fact that value can be created through mergers and acquisitions, implies that synergies can be created and exist. Firms should actually spend a bigger effort in value-creating activities, rather than wasting their resources only on bringing the two entities together in order to make the transaction official as soon as possible and preempt the competition. Organizing activities under a value-creation perspective rather than on a functional basis is the step to make in order to realize that potential (Chanmugam et al., 2005).

Scholars seem convinced about the potential coming from the realization of synergies, but what about practitioners? As a matter of fact, synergies are definitely and positively taken into consideration and believed in when it comes to deciding whether or not to proceed with such transactions. Mukherjee, Kiymaz and Baker (2004) carried out a study providing insights about motives for M&As, by asking CFOs directly. Synergies received 37.3% of the top-ranked responses to the question about the primary motive for acquisitions. Furthermore, 92% of the interviewed representatives declared that their firms were directly involved in synergy-related mergers. Other studies came to the same conclusion, making the relevance of synergies before, during and after the acquisition process, even more evident (KPMG, 1999; McKinsey, 2010).
3.3.2 Expectations VS Reality

The main problem associated with M&As in general, and synergies in particular, is that it is always difficult to predict if they are going to benefit the entities involved and, if so, by how much. We have already mentioned why M&As turn out to be a failure earlier in the paper. The focus here will be instead on why the forecasted synergies do not materialize, and how their value differs from what had been forecasted.

As a matter of fact, dealmakers are becoming better and better at identifying synergies. Some improvements have also been made in capturing them (Fichery, Herd and Pursche, 2007). Despite that, most of the companies engaging in mergers and acquisitions lack something when talking about synergies and therefore value creation. It is possible to identify some elements that acquirers miss when pursuing a transaction of this kind (De Camara, and Renjen, 2004; Fisery, Herd, and Pursche, 2007).

- Mistakes in identifying synergies. This is the origin of all problems when dealing with synergies. Mistakes like these are for example a too broad or too narrow definition of the added value coming from the acquisition. When this element is not estimated correctly, then the firm will end up not creating the value it had forecasted to generate. The valuation process is often biased as well. In most deals the entities that perform this task are investment bankers or big deal makers. They are not directly involved in the firm’s business, and their compensation does not depend on whether or not the deal turns out to be a success, but on whether or not the deal is actually pursued. This means that there are many agency problems mining also this process.

- Accelerating integration. Under the term post-merger integration are grouped all those plans the new entity puts into action in order to make sure it acts as one single firm. In order to avoid competition, firms need to act fast; what usually happens though is that they act too fast. In this way, they can miss important windows of opportunities and lose the chance to gain from them. This is why early and detailed planning is fundamental in these situations. Furthermore, going through an acquisition does not mean that companies should stop carrying out their usual business and serve customers: this is a common mistake in this situation, and a cause of the missed creation of value. The biggest challenges in the integration have been
analyzed in a study carried out by PwC in 2009. The authors attempted to pinpoint the keys to post-merger integration success, given the relevance of the topic. In this context the top 5 challenges in the integration process have been identified as the ones in figure 3.2 below.

**Figure 3.2 - Top 5 Challenges in Integration (Source: PwC, 2009).**

- Not having the right people available. Companies spend a lot of time and resources choosing the right candidate for the right position every day. As a consequence, this practice should be applied especially in a context as uncertain and risky as that of acquisitions. The full involvement of senior managers helps as well. They are supposed to be among the ones with most experience, and the ones who have the power to actually lead the merger in the right direction. On top of that, there are many regulations meant to control these processes, therefore making sure your team is clean is a very important extra step.

- Incorrect use of incentives. I have mentioned already the agency problems plaguing the relationships between managers and owners. That is only the tip of the iceberg though. Therefore, it is important that the right incentives are in place, in order to ensure that the plan is followed correctly and in the best interest of shareholders. A prerequisite for that is then a clear communication of plans.

- Mismatch between culture and systems. This element refers essentially to the fact that objectives need to be tied to actual measures. Only when it is easy to measure what has been achieved, synergies can be created. It is important then to integrate the different corporate cultures and make sure that the vision and mission is one.
Using the wrong process and failing to plan for synergies. It is important that things are carried out according to plans, but these plans need to be established through a holistic method. Sometimes wrong processes can have a big impact on synergies and their creation. It happens often that companies whose assets are put together have different business practices. Firms then tend to match them and create new best practices by the mix of the two. It can often happen though that the process becomes faster and more successful simply by identifying which of them is the best one, and adopting that one only. Of course, this is only possible when the culture of the new entity has been aligned as well.

Once the main reasons for the missed opportunity of realizing synergies have been listed, it is time to investigate if there is a way companies’ management could figure this out in advance and better value the feasibility of a merger or acquisition, by taking this uncertainty into consideration.

### 4 Synergies Valuation

KPMG (1999) has carried out a study on M&As, whose focus are the hard and the soft keys to success. The first group contains those elements whose correct development highly influences the realization of a successful merger. These are synergy valuation, integration project planning and due diligence. The second group instead is composed by three factors regarding people and culture. These are selecting the management team, resolving cultural issues and communication. Actual long-term success though can be realized if and only if these keys are combined together and if the company focuses on their joint development. Any of those activities alone was proved to be enough for a successful transaction, but only their blend turned out to be the first step towards that direction.

Synergy valuation is one of the hard keys, and therefore constitutes a stronger stepping-stone for avoiding failure. Specifically, the study found out that the companies that put priority on pre-deal valuation of synergies were 28% more likely than the average to achieve their goals within the transaction.

The purpose of this paper digs deeper into the results on KPMG’s study: by using an alternative method for valuating synergies, all the hard and soft keys proposed above are
better taken into consideration, and are therefore more likely to influence the final decision. As explained in the beginning of the paper, its purpose is to verify whether or not, by using a different method than the usual one for valuating synergies, companies would better forecast the results of a proposed merger. And by having a more likely overview of the value of the potential synergies stemming from such a transaction they would take better and more informed decision in the pre-deal phase. In order to do that, it is necessary to define a logical approach to the issue, by distinguishing some main steps. In the next sections I will proceed by:

- Describing how synergies are valued in common practice;
- Pointing out the pitfalls of such methods;
- Listing the elements that characterize synergies that must be taken into consideration in their valuation and that are not addressed by current methods;
- Identifying and describing an alternative method for synergy valuation.

Before looking at what the steps in the valuation process are though, it is important to make a first assumption. The value of control must be separated by the value of synergies (Damodaran, 2005). The former refers to the increase in value a bidder can get by taking control of a company whose organization is not so efficient. Through this distinction we can first make sure that there is no double counting. This could happen for example in a situation where a target has a lower return on capital due to the inefficient allocation and utilization of its assets. Secondly, when the value of synergies and that of control are positive, it is possible to structure an acquisition and integration strategy better tailored for the situation. This is the case when for example a bidder agrees to pay a high premium for acquiring control of the firm, but a small part of it reflects the value of synergies (since they could have not been generated without the acquiring firm).

4.1 The Status Quo

When a bidder is valuing an acquisition, it generally follows three main steps. First, the firms involved in the transaction need to be valuated independently. This is done simply by discounting the value of cash flows for each firm at the weighted average cost of capital of each firm. Second, the value of the post-acquisition firm is estimated by adding up the values obtained through the first step. Third and last, the value of synergy is calculated and added
to the value obtained at the previous step to find the value of the combined firm with synergies (Damodaran, 2005).

What is of concern in this paper is the third step alone, as stated above. Therefore it is important to look at how this is usually performed in real life.

Both operating and financial synergies are generally valued through the DCF approach. If this is the common practice, and if it has been proved that in a significant amount of acquisitions bidders pay more than 100% of the value of synergies (Damodaran, 2005) without them necessarily materializing, then it is fair to assume that this method must have some pitfalls.

4.1.1 The Pitfalls

If we first focus on the main elements that represent the inputs to this analysis, these are cash flows expected from synergies and the discount rate. In terms of operating synergies, calculating the (hopefully) increasing cash flows is particularly relevant. As an example, these could come from cost saving synergies, where the reduced cost-base achieved through the transaction would bring higher income, *ceteris paribus*. Estimating such numbers is not always easy (Carlsson and Fuller, 2003). This is particularly true as in this case they may depend on the subjective judgments of decision makers, who not only miss all the necessary data to do it, but are also often animated by hubris and opportunistic behaviors (Jensen, 1986). Uncertainty dominates the realization of synergies, therefore this issue is even more pronounced when dealing with such phenomena. For example, the cost synergies that might be achieved by combining two firms that sell consumer goods. They could join their efforts in terms of advertising campaigns and distribution, and save on those.

If and how these phenomena will materialize cannot be easily forecasted and many assumptions need to be made in order to calculate the present value of the consequent increase in income. It might seem easy for a short-term horizon, but when it comes to making estimates for a 10-year time span things get more difficult. The situation is further worsened by the fact that estimates for future years highly rely on those for the previous periods. Further difficulties are met in determining the value of growth synergies. This parameter estimates are even more dangerous, especially when the forecasted
improvements are perpetual. This is a highly theoretical hypothesis, and can easily lead to results that are definitely too promising.

As far as financial synergies are concerned instead, they include the estimate of the weighted average cost of capital for the new entity, which will serve as the discount rate for the free cash flows coming from the operational improvements. This also depends on many factors that are not easy to quote. First of all, the cost of equity the company will be able to get. By joining the assets of the two entities involved, it is likely that the firm will become less risky. This is especially true if the merger is an unrelated one, and the stand-alone entities are risky. In such a situation the achieved level of differentiation is higher and the benefits coming from a broader range of industries in which the new firm is operating are bigger as well (Hann, et al., 2009). Equity holders would start perceiving their investment in the company as more stable, and would therefore be willing to accept a slightly lower return on their capital. The same conclusions might be drawn for the cost of debt. This should decrease as a consequence of the more stable assets the firm owns at this point. Uncertainty is linked to the market premium and the sensitivity of these rates to movements in the market, according to the CAPM formula (Sharpe, 1964).

Estimating these elements can be as difficult as estimating cash flows. As a consequence, basing the calculation of the NPV of synergies on two very uncertain and fickle figures, the bad turns out of such a method are even amplified. Another pitfall of DCF in the valuation of financial synergies is that connected to the calculation of tax benefits. The latter can come either from higher tax deductions after the merger or acquisition, or from the opportunity to get a lower tax rate. Their value depends then on the tax rate itself, which is difficult to predict in advance with certainty, and on the income that will be taxed. That is hard to get right as well, as mentioned above, therefore difficulties just keep increasing when applying the Discounted Cash-Flows approach.

A final problem of the DCF analysis comes from the fact that it neglects the upside and downside potential stemming from synergies. As circumstances change, the value of synergies could increase or decrease in a direction that could be different than the one planned in the pre-deal phase. Higher flexibility might be achieved by acquiring a firm because, for instance, the markets that are served after the deal is done are different, or for
example because of the opportunity of earning more money by selling a newly acquired business unit. At the same time, the realization of synergies is a hard and effort-requiring process, which is another element that needs to be reflected in the value of synergies. As DCF does not account for changes in the different estimates made, and therefore proves to be a very static approach, an alternative is needed.

4.2 An alternative

The factors that negatively affect the commonly used approach for the valuation of synergies seem too many. Therefore the question now is whether or not another method could be used and if this method would give a better approximation of their value.

We have seen that synergy realization depends on a lot of variables, and the current methods are not good enough at capturing the flexibility they entail. Synergies often open up possibilities that would never be achievable for the firms involved in a transaction if they were keeping their businesses separate. For example, when a company buys another one that is operating in a completely different market, it does not simply do that. As a matter of fact, it buys an option to expand in that market. At the same time, if the target company owns a business unit that is underperforming, the bidder can potentially acquire the right to abandon that business if things keep going that way, and therefore capture the value coming from that divestment.

A concept that therefore seems to work very well for the valuation of synergies is that of real options.

5 The Real Options Revelation

In the next chapter a deeper discussion on real options is developed, and on how they can be of use for the valuation of synergies coming from an acquisition process. Specifically the thesis:

- Briefly describes what options are all about, distinguishing between financial and real options;
- Develops a discussion about why and how real options and synergies can be used together;
• Lists which circumstances need to be in place in order to effectively apply this approach;
• Defines which methods can be used to valuate them and finally choose one for the scope of this paper.

5.1 A general distinction

5.1.1 Financial options: a brief digression

Before deepening the discussion about the topic of real options it is worth making a brief distinction between financial options and real ones. The formers are essentially the ancestors of the latters. As far as financial options are concerned, when an investor buys one he gets the right to do something at a specific point in time, if it is a so-called European option, or whenever before a deadline, if it is an American option instead. More specifically, if we consider European options for example, an investor can buy the right to buy (sell) an underlying activity, at a fixed exercise price, and at a specific point in time. When the deadline is reached the investor will choose to exercise (not exercise) its right to buy (sell) the underlying activity, if its price on the market is higher (lower) than the exercise price. In this way he will get a payoff that equals the difference between the underlying asset’s price and the exercise price. The opposite is also a possibility, of course, and an investor will act accordingly to circumstances. Whatever the kind of option we take into consideration, they all depend, in different ways, on the same variables. These are exercise price, the price of the underlying activity, the deadline at which the investor must decide whether or not to exercise his right, and the volatility of the price of the underlying asset. Financial options will not be a focus of this thesis, thus any discussion about them and their methods of valuation is limited to this.

5.1.2 Real Options

Real options directly derive from financial options, but the underlying assets are represented here by opportunities the company acquires. A real option for an oil company could be, for example, represented by the chance it has to extend a contract with a drilling operator, if the oil field turns out to produce more than expected. This right is very advantageous for the company in question, since in the lucky case these circumstances arise,
then it will save time and money it would need to spend if it needed to hire a new drilling contractor. Exactly as financial options then, real options are tied to the condition of a specific event materializing. Through such instruments firms can scale their investments and avoid committing an excessive amount of resources and capabilities to an uncertain deal.

Real options can be defined as investment characterized by three elements. Uncertainty is one of them. It refers to the fact that it is often very difficult, if not impossible, to identify, value and control all the variables that surround a specific decision. The second element is the fact that this investment will provide the management board of discretion to exercise a right at a future and appropriate time. This means that through real options managers are not bounded to taking a decision immediately, but can stage the process according to circumstances. Finally, the investment decision that constitutes the base of a real option needs to be irreversible. It is such when it cannot be costlessly revisited afterwards (Kogut and Kulatilaka, 2001).

It is possible to distinguish three main categories of real options (Brealey et al., 2011):

- Option to expand: it arises when a company has the right to expand its operations when circumstances are good. Imagine for instance a company that acquires another one that is producing a different product and commercializing it in a completely different market. The bidder could take into consideration using the target’s distribution channels to merchandise its own product. If it was afraid that demand would not be stable enough, then it could just start with a pilot, without having to commit a lot of resources by building new facilities in the newly acquired market or spending a lot of money in planning how many pieces to actually produce for exporting, or take care of the subsequent transportation. Marketing expenses would be avoided as well, by using the network the target company already has. It could, for example, offer the bidder's product in a bundle with the target's one for some time and see how it goes. This option is equivalent to a call option.

- Timing option: when a project has a positive NPV, it might seem natural to undertake it, expecting positive cash flows from it. Although that is the general rule, it does not mean that if we waited a little longer we could not get a higher payoff. This is why an
option to choose the most suitable time to make an investment has value. Suppose that your company is contemplating to build a bicycle factory in Denmark, and that it can decide whenever it wants to make the investment and actually build it. In this scenario as a member of the management board you would hold a call option on the future cash flows of this factory, but you would face a trade-off. If you were targeting Copenhageners, whose 50% commute to work or study by bike everyday, you would be facing a very big market, but also a quite saturated one. As a consequence you would be facing high uncertainty, and actually seeing how things are going before committing resources in the factory would put your company at ease. Therefore you could exercise the option right away, if the market suddenly experiences a boom, or wait if you forecasted that in the next year a much higher number of foreigners will move to the city and increase its size.

• Option to abandon: it is the opposite of an option to expand. It is particularly useful when a bad situation arises. Imagine that you own a business, and things turn out to be worse than expected. Cash flows are declining, and demand for one of your products is falling tremendously. At this point the best thing to do seems to actually abandon the business unit that is producing that good, and just recover as much as possible in terms of value of assets, project’s plant and equipment, and so on. This option is therefore comparable to a put option, as the firm who owns it has the right to sell one or more assets, plants or business units when the situation calls for extreme measures. In this way the downside potential is limited, as well as losses.

5.2 Synergies as Real Options

It has been mentioned above, that investments in the form of real options can be characterized as uncertain, as able to get the management discretion on whether or not to exercise their right, and as irreversible (Kogut and Kulatilaka, 2001). It is straightforward then, that as long as synergies match these characteristics, then they can be treated and valued as real options.

5.2.1 The uncertainty of Synergies

Synergies are highly uncertain. Uncertainty can be defined as something depending on external characteristics. Specifically, it refers to circumstances in which a range and
probability distribution of potential events cannot be determined in advance (Kay and Diamantopoulos, 1987). Based on this definition then, it can be argued that synergies are tremendously uncertain, and therefore require relevant management actions and direction (Kinnunen, 2010). As a consequence, they turn out to be very difficult to value, and many acquisitions end up destroying value, rather than creating it. This is why a method that better takes care of valuating this aspect as well is needed.

Synergies are difficult to determine under different perspectives. First of all, it is difficult to predict whether or not synergies are actually going to materialize once the transaction is done. This is true especially if we look at the ex-ante forecasts made by a bidder, and the actual ex-post consequences of a deal. The motives for the missed realization of synergies have been mentioned already, and will not be further discussed here.

Not only uncertainty is linked to whether or not synergies will materialize, but it also concerns at which point in time they will be realized. If they are seen as real options then, their valuation will also take the best timing for exercising them, supposing they exist (Alvarez and Stenbacka, 2006). In this way, it is possible to define the distribution of the surplus created by the merger or acquisition, and through the following restructuring of the assets involved. Through this approach, uncertainty is therefore reduced, and decisions can be made under more comprehensive circumstances.

Following these two aspects, uncertainty finally regards the valuation of synergies as well (Dutordoir, et al., 2014). This is what the main focus of the paper will be, when trying to define whether or not real options allow dealmakers to get a more precise and less biased value for the synergies expected from a transaction. This topic will be further developed throughout the paper.

5.2.2 Managerial Discretion

It has been said already, that synergies do not simply materialize by themselves. There are many investments bidders need to put into place, and an indefinite amount of other resources linked to their realization. Who ultimately decides whether or not to pursue these commitments is the management of the company involved. The circumstances under which the latter decides will not be discussed here, but this is enough to see how synergies can be
considered as real options under another aspect. Managerial discretion ultimately refers to the group of activities and actions put into place within the post-deal integration process.

It is possible to identify different steps in the exploitation of synergy potential (Vizjak, 1994). The first step is characterized by the definition of the so-called affinity groups. This procedure consists in the classification of the different newly created business clusters, characterized by market and product affinities. This means essentially that those business units that have the same combination of the latter elements will be part of the same cluster.

Proceeding to the second step, it is necessary to focus on three different phases. Firstly, interrelationships within the different clusters need to be identified. Secondly, they need to be quantified. Finally, resource overlaps need to be analyzed in detail as well. They might come from the increase in costs or coordination and compromises between the different business units. The latter case refers to the lower utility achieved by two different business units, that need to adapt to the other’s needs in order to share resources and capabilities. The new allocation required by an acquisition might represent a sub-optimal choice for both business units involved, thus this phenomenon necessarily leads to higher costs.

The third step is dedicated to the identification of the synergy potential. It includes the valuation of synergies, whose potential realizes only when the benefits of interrelationships exceed the costs of the diseconomies identified at step two. Imagine a situation where two newly merged entities opt for sharing logistics systems, but they produce goods that differ widely in size, weight or delivery rate. In this case, none of the two can totally benefit from the joint logistics, and therefore a suboptimal situation is reached. If these losses exceed the positive potential of synergies, and therefore the economies of scale reached through the combination of logistics facilities in the aforementioned example, it is easy to see that the net value of synergies becomes negative.

The fourth step consists in the development of a horizontal strategy. This is strictly linked to the actual possibility to realize the potential of synergies and therefore creating value through a merger. It includes integration of existing businesses, both on an operational perspective and a strategic, long-term one; the standardization of processes, necessary in order to achieve further cost savings; physical configuration of the value chain, particularly
important to exploit the benefits coming from the best allocation of infrastructures and resources around the globe.

The fifth and final step instead is represented by the actual implementation of the horizontal strategy developed during the previous phase. How this can go wrong has been said already, and will therefore not be further discussed.

It is easy to see here then, that steps three and four gain particular relevance in terms of managerial discretion after a merger or acquisition. It is during these phases that managers can, after careful consideration, verify whether or not the value of synergies exceeds its costs. If it does, they need to decide how to actually pursue this value, and they do that by exercising the right to exploit these synergies, which is embedded in the transaction just realized.

5.2.3 Irreversibility

Mergers and acquisition are time and resource consuming transactions. Through them companies do not only achieve benefits, when synergies work out as, or better than, expected. They also need to spend lots of money on implementing their integration strategy, on top of regulatory fees and other sources of costs. These are typically once-in-a-lifetime costs. As a consequence of the fact these are sunk costs, a merger or acquisition can be interpreted as an irreversible (or at least partially so) phenomenon (Lambrecht, 2004).

Irreversibility of investments usually arises from the fact that an investment is firm specific (Pindyck, 1990). This means that the latter can be used productively only by that firm, in that specific industry. When a company invests in merging production facilities for instance, it completely revolutionizes the way things used to be, and reorganizes the assets of the two previously independent companies. As far as synergies are concerned then, they can be defined as value adding opportunities that are very rarely fully priced in the market, since they are exclusively available in all their potential only for a determined acquirer (Kinnunen, 2010). An example is that of two companies that produce complementary products. Imagine a company producing software, and another one producing hardware, therefore computers. By joining their efforts, they can achieve higher returns. The investment required by synergies then is irreversible as well.
5.3 The importance of real options as a learning tool

Entrepreneurial initiatives are decisions that often have uncertain implications. Specifically, deciding to make such decisions means acknowledging that there is an irreducible uncertainty that cannot be easily, if not at all, reduced in the beginning (Venkataraman, 1997). As a consequence, entrepreneurial plans are not simply “variations, random mutations, or bold new adventures, but as real options” (McGrath, 1999). Only by analyzing how things are evolving it is possible to reduce such uncertainty, but of course this decline does not necessarily mean that the firm is better off.

People generally seek success and try to avoid failures the most they can. This is what happens through the usual valuation of cash flows from acquiring activities, where forecasts are almost all the time rosier than one would expect in real life. This tendency might lead to some mistakes, which can be instead avoided by using real options, which take into consideration downside risk of investments and managerial plans (McGrath, 1999).

A first problem is the tendency to extrapolate to the future from past success. This refers to the fact that humans tend to generalize when observing something. When talking about failure and success, the latter is seen as more likely than it actually is, while the opposite happens when looking at failure. This phenomenon can be called loss aversion, and has been clearly described by the cumulative prospect theory (Tversky and Kahneman, 1992). The basic hypothesis here is that a loss is not perceived exactly as the opposite of a gain. This means that a one-unit loss cannot be covered simply by a one-unit gain, but more of the latter is necessary in order for the situation to be perceived as unchanged. A second implication of this theory is that the more uncertain profit opportunities ahead are, the higher the risk aversion will be. This is reflected clearly in the behavior of individuals, and the usual DCF approach encourages it. Real options instead, take into consideration potential changes in the circumstances surrounding the decision makers, and therefore help companies better valuing all the options they can choose among. Finally, all the factors that strongly predict performance are seen as less influential and weaker than they really are.

With the suggested approach instead, you can include many more elements in the analysis. And the more elements you consider when valuing projects or synergies, the more likely it will be for you to predict the actual value.
A second issue is cognitive biases linked to the bounded rationality of individuals. They materialize in different ways. First of all, people generally have problems forecasting the probability of events to occur. Specifically, they often exaggerate the representativeness of small samples. If they see the answer they were looking for, they tend to stop looking. Another cognitive bias comes from the fact that it is easier for people to just approach new challenges and problems by applying tools developed in previous ones. Companies get easily accustomed to routines that have been developed through the years, but circumstances change, and it is not always easy to find contingencies that match another in all their elements. Firms risk staying static and easily losing flexibility. Real options instead give them back the flexibility they lost, which is instead highly needed when pursuing valuations of synergies for example. You never know what future has in store for you. And this flexibility is not explained by the fact that real options replace a stream of cash flows of smaller payments with a lump sum, which is not the case. Instead, they give the management the chance to stop a flow of payments when it turns out to be negative, as well as they allow it to increase investments and resources committed in those areas that are particularly productive.

Short-term focus and shortsightedness are other issues within common practice as well. The first refers essentially to the fact that things closer in time receive disproportional attention compared to those expected to happen further in time within the decision process. A consequence of such a bias is the tendency to procrastinate (Hendrikse, 2003). By doing that, companies might miss windows of fruitful opportunities. Real options instead help individuals take into consideration the value of opportunities and investments at different points in time, showing when the value of exercising the option is at its peak, given all possible circumstances.

If entrepreneurial activities represent an effort to introduce a new combination of resources, a generalization about M&As can be made as well. The latters are activities whose goal is that of restructuring assets of two independent companies by putting them together. This translates into a new combination of resources, which is different from the simple sum of the assets of the two stand-alone entities involved in the transaction. This difference is given by synergies, as discussed above, which means that synergies are entrepreneurial
activities. As a result, as the latters can be seen as real options and interpreted through them, synergies can be valued through that lens as well.

5.4 The Value of a Company: A Real Option Perspective

Since synergies and the investments required for their realization are uncertain, give management discretion, and are irreversible, synergies can be seen as real options.

According to this perspective it is possible to differentiate the components of the value of a target firm from the way it is usually calculate through a DCF perspective. Specifically, it is possible to see an M&A as a transaction followed by a mix of real options that will turn into synergies, and therefore will hopefully generate a positive value (Kinnunen, 2010). As a consequence, what a bidder is interested in is the total value of the target firm, thus including the value of the real options embedded in the deal, i.e. the ones that are only available to the newly created entity, and were not achievable without its creation.

Three elements need to be identified and correctly estimated: the target’s economic capital, the target’s strategic capital, and lastly the total value of the target as a part of the acquirer (Figure 4).

While the target’s economic capital is simply given by the valuation of assets in place, the target’s strategic capital consists in adding up the real options the target holds. These are out-of-the-money options that the acquired company holds as a stand-alone firm, but that are not convenient exercising given the situation. A target company operating in the cosmetics industry could for example produce the best products in the industry, but miss an
extremely qualified sales force. If we assume the company's strategy is that of selling its products door-to-door, that does not make things look better. Its management could then decide to keep things as they are, or invest more time and resources in hiring more qualified people for approaching customers. Sometimes this is simply impossible: it requires big investments. It is easy to interpret this opportunity as a real option for the target company, an option to expand, but it is an out-of-the-money one.

A final step in finding the value of the target company is given by the identification of the value added through the transaction. This comes from the fact that the real options the target was holding before it, are now turned into in-the-money options and are therefore convenient to exercise. Continuing the example of the cosmetics company, it could be that a bidder has instead the opposite problem: a great sales force, but a product that customers do not like so much. As a consequence, by restructuring the assets of the two companies and putting them together, it would be now possible to exercise the option of combining the distribution and production of two different companies, reducing resources overlaps.

The distinction between the different categories of real options needs to be updated then, in order to take into consideration the relationship between synergies and them (Kinnunen, 2010). These value-adding real options are:

- The option to create synergies, which arises only after an M&A deal. It consists of the right the bidder company or the management of the new entity in case of a merger to redeplo the resources available. This is done either by simply reorganizing the newly created or integrated entity, or by doing that and adding some other investments. The management has full discretion in these issues, and will hopefully choose well based on the circumstances. This option enforces the idea of valuing synergies through real options lenses.

- The option to split existing businesses into smaller parts. Imagine a situation where a target firm has many different business units, which also include non-core businesses and are not performing so well either. When the transaction has taken place, this structure can be dismantled and the different unprofitable or superfluous parts can be sold or closed down.
The option to divest part of the target, which regards non-core businesses and unsuccessful operations. It is the right to sell part of a target’s business or assets, or the option to stop all operations and production activities in the case the acquisition turns out to be unprofitable. The situation where only parts or assets of the target are sold represents a put option for the acquiring firm, while the more extreme case in which immediate close down of operations is required looks more like the option to exit.

It seems then that synergies actually resemble real options, and therefore the methods used to determine the value of the latters can be used to value the formers as well.

There are some limitations to the range of investments and decisions that can be analyzed through a real options approach though. This matter will be dealt with in the next paragraph.

5.5 Real Options Boundaries

It has already been said that one of the best aspects characterizing real options is their flexibility. This aspect does not apply to all investments and situations though, and it is worth talking about the limits of real options application, with a particular focus on how these affect synergy valuation.

The first limitations come from the levels of uncertainty and irreversibility of the investment made. These have already been more deeply analyzed in relation to synergies in the previous sections, and therefore will only be touched on here. In order to better understand which kind of synergies can be valued as real options, it is possible to look at figure 5 (Adner, and Levinthal, 2004). The higher the uncertainty and the irreversibility of the investment made in order to realize the planned synergies, the more room there is for the application of RO logic. As long as synergies are highly uncertain and irreversible, then they can be valued through it.

![Figure 5.1 - Boundaries of Applicability for NPV and RO](image_url)
On another level, it is necessary to distinguish between RO and path-dependent investments. Specifically, the identification of the two depends on the characterization of the target market, and the technical agenda. When they are fixed, then the investment can be characterized as a RO (see Figure 6). If the scope of the synergies that might be captured by a merger can be fixed a priori, which means that the various opportunities available once the transaction has taken place are clearly specified and articulated, then the flexibility associated with this option can be easily maintained (Adner, and Levinthal, 2004). Otherwise, the investment simply depicts a path-dependent one.

To conclude, when the planned synergies fall within the boundaries of applicability of real options, both in terms of uncertainty and irreversibility, and in terms of target market and technical agenda, then a real options approach is significant.

6 The case: DaimlerChrysler

It has been said that synergy realization is one of the most difficult tasks to perform, once a merger or acquisition takes place. Plenty of money is wasted in order to turn expectations into reality, but sometimes the premises are wrong. Hubris, empire building, and other external circumstances might push the management of a company to accept a deal without properly weighting the pros and cons of such a revolutionizing transaction.

The aim of the paper is to verify whether or not real options are a better tool for valuating the synergies. This means analyzing the potential of real options to capture aspects neglected by the DCF approach, given the formers’ characteristic of taking into consideration negative outcomes as well. As a consequence, if RO are actually more precise and reliable than the latter approach, then when synergies are not meant to be realized and therefore to exceed the costs of the transaction itself, their value should be lower. Facing the more likely possibility of wasting time and resources on synergies whose value for
shareholders is not as high as postulated, management will more likely be inclined towards rejecting such a deal. This will translate into enormous savings for the bidder, but also for the other entities involved.

For this purpose it is relevant to look at a past merger, whose turnout was not as rosy as expected, and whose prospects were calculated through a traditional DCF approach. Analyzing the entire background from a broader perspective, and introducing the downside potential incorporated in a RO approach to the case, the synergies hoped for at the time of the transaction will be rvalued. In this way, it will be possible to:

- Verify if the newly calculated value differs from the one initially proposed by analysts at the time of the merger;
- Prove whether or not real options have turned out to be a better approach;
- Hypothesize which decision the management would have taken if it had adopted this approach from the beginning.

The case chosen for the analysis is the world’s largest cross-border deal between the German car producer Daimler-Benz and the American Chrysler, which took place in 1998. The reasons why this merger was chosen will be discussed in more detail in the following sections of the paper.

### 6.1 The automotive industry

This part of the study will focus on the choice of the industry, and highlight the specific factors characterizing it in the 90s. The automotive industry will be analyzed both in a broader perspective, and then focalizing more on regional markets. Specifically, the different ones the focus will be on in this paper are the ones particularly significant for the scope of the merger.

#### 6.1.1 The choice

The main reason why this industry was chosen is given by the peculiar situation it was going through during the 90s. The increasing expectations of customers in terms of quality and design of cars, together with the big investments required to finance these plans and run them, make it technologically sophisticated and capital-intensive. As a consequence, in order to stay competitive and still catch big shares of the market, the only viable way was
consolidation.

The automotive industry is defined by many as a typical example of a business whose manufacturers number is always decreasing, as a consequence of the enormous potential that can be gained here through economies of scale. It is necessary to make a brief clarification though. When talking about consolidation, what I am referring to here is industry consolidation, and not market consolidation. The first term identifies the situation in which the number of manufacturers in a country or in the world decreases. The second term instead refers to the fact that the number of providers in a specific market falls.

The years before the DaimlerChrysler merger were characterized by this phenomenon in most of the major markets, and a real globalization trend affected this period. If we take a deeper look at Germany, for example, where this phenomenon was stronger than in many other countries, the peak was reached here after the Second World War. It is possible to see how the consolidation worked in this market in the figure below (KPMG, 2010).

![Figure 6.1 - The Consolidation of the German Automotive Industry](image)

The requalification of the automotive industry from military to civil utilization generated a boost in the industry, where many producers entered the market with small cars. These did not match the preferences of customers though, who were experiencing the economic boom as well, and were therefore looking for something a bit more sophisticated compared to what was being offered. This led to a premature exit of many new entrants from the market. On the contrary, premium cars started gaining momentum, which allowed producers of
such vehicles to pursue a consolidation strategy (KPMG, 2010). Economies of scale did not have a particular role in these circumstances, and motor vehicle manufacturers could survive even with relatively small numbers of units sold.

Consolidation happened through mergers and acquisitions, which substantially reduced the number of players. The period coincides with the beginning of a merger wave, which involved not only companies that wanted to get a higher level of vertical integration, but also those trying to reach broader markets and increase their sales. During merger waves, many deals were simply pushed by circumstances and by the will of companies to catch up their competitors, trying to increase their size. The failure rate for M&As has already been discussed, as well as the importance of taking into consideration all the different variables and valuating them correctly, in order to make the right decision regarding. The premises of deals taken into these circumstances can then be defined as weak and not thought through, which means that these transactions are more likely to lead to negative outcomes for the parties involved. As a consequence, choosing a merger happened in such situation seems to be more appropriate. This is because, if the premises were wrong, but the deal has been approved anyway and has turned out unsuccessful, then it necessarily means that the value added by the merger was overestimated. Given the purpose of this paper, if RO are actually a better tool than DCF, then it should be seen in a case happened in the automotive industry.

6.1.2 The Triad regions

In the years surrounding the merger, the vehicle markets of North America and Western Europe, together with the other member of the Triad regions, i.e. Japan, experienced a slow-growth period, as a consequence of their maturity.

First of all they were affected by overcapacity. Specifically, in the years between 1990 and 1997 while production increased at a rate of 4.2%, sales increased only by 0.6% (Humphrey, and Memedovic, 2003).

Secondly, the industry in these regions was characterized by increasing cost pressures. This was true especially because of the much cheaper cars that were being imported from other countries, such as China, that could produce cars of the same quality and the same specifications, but at a much lower price. In an attempt to reduce the impact of this tendency,
the different vehicle producers in the Triad started to look for ways to make their processes more efficient, and therefore reduce costs. An example is given by the general tendency in the industry to start sharing the different platforms for the production of similar vehicles. In this way, more standardization was possible, and economies of scope reached. Lean production was of course on the agenda as well, and all the different manufacturers tried to pursue its benefits. Daimler-Benz was actually the only company that reversed this strategy, by doing the opposite instead. Its newly nominated CEO, Schremmp, was sure it was necessary to have a platform for every model, in order to produce each of them the best way possible and without compromising the products quality.

Another example, on another level of the production chain, is given by the development of closer ties with suppliers. Companies started involving them more in the design phases. On one hand they were called in by the companies and consulted about the characteristics their final product should have in order to be compatible with the components needed. On the other hand they were also in charge of actually assembling some of the vehicle’s parts. It could be, for instance, that they were in charge of putting the seats together. In this case, they would need to find the suppliers of the other parts needed to build one, in addition to theirs, and then purchase them so that they matched the latters. In this way not only the company could get the parts needed at lower prices, and make sure that some of the parts of their final product had been built using compatible products and designs, but also suppliers could benefit from adapting their products to the demand, and therefore selling more units.

Finally, these elements affecting the automotive industry, led to a lower profitability in North America, Western Europe and Japan. Although high volumes were sold in these markets, they were not being as profitable as in the beginning. For instance, in the US vehicle market sales recorded in 1996 were 5% lower than the level reached ten years before. Despite this negative trend though, it was possible to see that customers’ preferences were changing in that specific market. The real revenue per vehicle increased by 14%, as a consequence of the shift from cars to trucks that took place over the previous decade (Strauss, 1997).
6.1.3 Globalization in the Automotive Industry

The challenges manufacturers were facing in the Triad markets were not being experienced everywhere else. While the formers were destined to be an important reference point in the automotive industry, the growth they were characterized by was not nearly as high as the one some of the emerging markets were undergoing. As growth in vehicle sales is tightly linked to that of GDP, then the latters represented a huge source of profits for manufacturers. As a matter of fact, their GDP was expected to grow at double the one in the Triad markets, which was instead expected to equal 2.50% in the following ten years. There emerging markets included Asia Pacific, Latin America, Central and Eastern Europe. Figure 6.2 represents the relationship between vehicles sales and real GDP in the years between 1996 and 2006 (actual and forecasted), and how the different markets were positioned within those measures (Strauss, 1997).

It is possible to see how the markets just mentioned were placed in to top right corner of the graph, which means their GDP and vehicle sales were both high, which for sure indicated the presence of a big potential in those areas.

Before the 90s the situation in the Triad regions was still under control. In particular, there were many law regulations in the developing national countries, which prevented foreign goods to reach these markets and the government kept out capital ownership from these areas. The different policies in force there aimed at guaranteeing the host country to be able to keep a working and healthy infrastructure if and when foreign capitals were divested from the country. This means that developed nations were often not willing to make big investments in the latter countries, as they did not want to deal with such regulations and unstable governments. Staying out from emerging markets was not a problem in that historical moment, but when new entrants reached the market, approaching new realities
became a necessity. In the US for example, Japanese car producers started selling their products in the 90s. In this way they added even more capacity to a market that was already saturated and where competition was already fierce. At this point companies first established only in developed countries started making direct investments in Asia Pacific, Latin America and Central and Western Europe, in order to overcome the low profitability, overcapacity and cost pressures characterizing their original markets.

The emerging nations were experiencing a very high growth rate in the 90s, as mentioned above. This was a result of an increase in disposable income, a lower saturation in the market and a limited number of available production facilities that were able to support the potential local demand. The fast-growing emerging markets all together increased vehicle sales by 80% and production by 93% in the years between 1990 and 1997 (Humphrey, and Memedovic, 2003). As a result of the high potential in these areas, and the extremely low chances of increasing profitability in the Triad markets, car assemblers from these areas started making extensive direct investments in developing countries, in an attempt to spread vehicle development costs, establish cheap production sites and access new markets for higher-end vehicles (Humphrey, and Memedovic, 2003). Mexico and Brazil were under the spotlight during this globalization process. Many existing vehicle manufacturers started investing in Latin America in 1994-1995, as well as a number of new entrants started making plans to join the formers. For instance GM, Ford, VW Group, Chrysler and Nissan had invested in plants in Mexico in the beginning of the 90s, and were joined at the end of the decade by Honda as well. In Brazil the tendency was even bigger, as the number of existing manufacturers establishing plants there doubled over the period, and some of them had more than one infrastructure built (Humphrey, and Memedovic, 2003).

6.1.4 The challenges of developing countries

Despite the extraordinary potential in these areas, and especially in Latin America, the challenges there were many. Three elements are generally giving more problems when talking about expanding operations in developing countries (Humphrey at al., 2000):

- Political uncertainty,
- Changes in demand, and
- Exchange rates.
Political uncertainty refers both to internal aspects, which include relations with local authorities, and external ones, which deal with international expansion instead. This category is therefore represented by slowing economies, oppressive regimes and broad societal changes. When dealing with strong legislations, corruption and powerful political exponents, it is difficult to profit from the operations carried out in this situation. As an example, Chrysler thought to have an arrangement with the Chinese government to build a minivan factory in China. This permit was instead given to Mercedes-Benz afterwards, despite the American company had already negotiated that. Another example of the uncertainty surrounding international expansion and globalization is the one of Latin America, and Brazil in particular. Here the government suddenly decided to increase its tariffs on cars, first to 32%, and then to 70%, as a consequence of an unexpected increase in imports, threatening the national production.

Market uncertainty can be defined as that depending on the unpredictability of demand. Flexibility is therefore very important for companies, especially for those operating in industries where the existing technology can be challenged easily, and substitutes can be found effortlessly. On top of that, in those areas where income is growing but its development is hard to forecast, demand consequently becomes more difficult to interpret.

A relatively easy way to adapt to changing demand is that of scaling labor accordingly to a firm’s needs. Although this might sound easy to do and without major consequences, it creates a vicious circle, that leads to even bigger fluctuations of the macroeconomic variables within the nation. For example, in the years right before DaimlerChrysler’s merger, the number of motor vehicles in Argentina, another relevant developing country in this situation, dropped by 36.6%, and in Mexico the circumstances were even worse, since the number fell by 69.3% (Humphrey et al., 2000). If a company operating in those markets fired employees as a response to this downturn, unemployment would increase, and generate a drop in income. This would in turn cause another reduction of demand, and therefore lead that same company to further reduce its personnel, and so on.

The difficulty in predicting and forecasting this variable depends on the extreme market segmentation characterizing these markets as well (Humphrey et al., 2000). An increase in demand is generally associated with a rising middle class. That is not necessarily true in
developing countries though. Actually the market of used car is quite strong there, where infrastructures are not good enough to support the population’s demand for newly built cars. As a consequence, people still prefer draw upon public transportation, which is anyway a much cheaper solution. Finally, despite the increasing trend, disposable income is still low, and not high enough to fund a purchase of this kind, and prices are unstable (Vlasic, and Stertz, 2000).

A final element determining the risky nature of investments in emerging markets is given by exchange rates. The automotive industry is capital intensive, and many were the direct investments made by the main car producers in the emerging economies during the 90s. As for all investments, the shorter you have to wait before getting a positive payoff from them, the better it is. When investments are cross-national, this puts a lot of pressure on exchange rates. In developing countries those circumstances can only be even more stressed out. Of course changes in exchange rates influence the automotive industry as well.

As interest rates increase to defend the national currency, the cost of debt incurred for financing the production of vehicles obviously increases, negatively affecting the producers. The cost of debt increases for the people accessing it in order to buy a car in the first place, reducing their demand for one. Besides that, the general recession that is associated with a financial crisis such as that of fluctuating exchange rates, has a negative effect on the economy, and also generates pessimistic forecasts, further worsened by unemployment. This certainly reduces the household income and, as a result, consumption. Additionally when the price of imported goods increases, exports become more convenient instead.

To conclude, despite the numerous attractive elements that characterized emerging markets in the years surrounding the merger, the challenges that needed to be taken into consideration were at least as many. These kind of developments should definitely be taken into account when calculating the value of synergies, as such different threats could reduce their value.

6.2 The companies

In the next two sections the two companies, Daimler-Benz and Chrysler, will be briefly described in order to better understand the background and identify the main points in their respective national and international strategies.
The choice of this merger within the automotive industry has depended upon the fact that it was a cross-national merger, and therefore the investments made were particularly big. On top of that, it turned out to be a failure, and the forecasted synergies were not realized as expected, ending up destroying value rather than creating it. Finally, in order to make the analysis more complete and trustworthy, I have chosen a case for which a big amount of information is available.

This means that if the RO approach actually turns out to correctly predict the result of the merger, then valuating a deal through this method should acquire even more relevance. When the financial and non financial resources committed to a project are high, anybody would of course prefer to be sure about the decision to make, and reduce the uncertainty associated with the situation.

6.2.1 The German shepherd: Daimler-Benz

The pioneers of the automobile manufacturing in the late 19th century were Gottlieb Daimler and Carl Benz. The war presented many challenges for German vehicle producers, as the militarization of production had produced many changes along the entire productive chain. Negative effects on this industry came also from the collapse of the German currency, the growing number of new automobile companies, not only from the national boundaries but also from abroad, and the loss of important foreign markets. As a result the German automotive industry fell into a crisis, and one of the easiest ways to achieve economies of scale and therefore save money, companies were led to form larger units, through transactions. An example is that of Daimler’s Daimler Motorengesellschaft (DMG), which then merged with Benz’s Rheinische Gasmotorenfabrik in 1926, as a response to the existing situation.

After a period of civilian car production, the company needed to convert its facilities into those capable of building military vehicles, destined to being used in the Second World War. Despite the negative consequences of the conflict, such as the loss of all its foreign subsidiaries, affiliates and branches as well as all assets in the Soviet-occupied area, Daimler-Benz rose from ashes and was able to establish itself as a synonym of quality and craftsmanship. In the years between 1949 and 1960 the company managed to regain the position it had been enjoying before the War, and broke the sales record existing at the time.
In those years the firm also started diversifying its offerings, and expanding in foreign markets as well. On one hand, in the commercial vehicles category, it started producing everything between a light van and a heavy-duty truck. It then started to produce bus and coaches, as a consequence of the newly born demand in this field. On the other hand instead, in the passenger cars segment, the focus of Daimler-Benz, whose brand became Mercedes-Benz, kept being that of upmarket and technically sophisticated vehicles, designed and produced with extreme craftsmanship. In these years, the company reached the point where the demand for its products was higher than what it was actually able to produce.

After the oil crisis of the 70s, and the advance of new Asian competitors in the market that were offering the same products in terms of quality and design, but at a much lower price, Daimler-Benz started experiencing declining operating profits after an era of continuously increasing ones. In an attempt to keep the company safe from excessive fluctuations, the Chairman Reuter approved a series of initiatives aimed at enlarging the corporate portfolio. It was then that the company diversified even further into sectors like electronics, aviation and services.

6.2.1.1 The years right before the merger
The diversification process did not lead to the results the company had hoped for. As a consequence, after the new chairman Schrempp was elected, a strategic flip was given to Daimler-Benz’s way of doing things. As a consequence, all those businesses that were far from the core were abandoned, as they were not making any profit. The firm went therefore back to concentrating on automotive mobility, transportation and services.

At this point in time the business was made of five different categories:

- Passenger cars. Revenues here increased by 19% in 1997 (Daimler-Benz, 1997), and the company decided to focus more on those countries where growth was expected to be higher, i.e. the emerging countries. Specifically it was recognized that growth for passenger cars in the industrialized world would be coming from vehicles such as minivans, off-road vehicles, roadsters and convertibles. The decision to look at new markets came also from the fact that competition was getting stronger in the Triad regions, as said above, and the labor costs for Daimler-Benz were particularly high (Daimler-Benz, 1997), therefore developing countries represented a good
alternative. Figure 6.3 (Daimler-Benz, 1997) shows the division of Daimler-Benz’s revenues by Region. Sales in all areas slightly increased, despite the negative trends affecting the USA in that period. This was a result not only of the great reaction markets had to the new models launched during that period, but also of the upward valuation of the US dollar against the German mark. As a matter of fact, despite the cost pressures experienced, passenger cars reached an all-time high in terms of revenues and production.

- Commercial vehicles. Sales and revenues increased in this segment as well. This was due mostly to the very good performance recorded in the vans and heavy trucks divisions in Europe, but also the commercial vehicle units in North and Latin America. This was made possible by the introduction of new models, which could be more cost-effectively produced thanks to their streamlined production processes and vertical integration (Daimler-Benz, 1997). As a result, the company’s vertical integration reached 40%. This big category included also the production of trains and buses. Also here the focus became that of expanding the firm’s presence in emerging countries. The positions in Latin America could be reinforced thanks to the creation of the business unit Commercial Vehicles Latin America that took place in the beginning of 1997. On top of that, Asia represented the biggest market at the time, and was expected to grow at a very high rate. To grab a slice of this development as well, Schrempp planned to offer more locally produced and developed products there, which could be adapted to customer needs.

- Aerospace. 1997 was characterized by the development of favorable economic conditions for the aerospace division. In contrast though, the budget of public sectors
reduced, which had a negative impact on it. A bitter price war was also initiated in the industry.

- **Services.** This category included financial services and insurance brokerage, IT services, telecommunication and media services, trading and real estate management. Their growth remained strong, and the demand from industrialized countries was one of the main pillars of this development. The latter was so strong, that the division's contribution to the operating profit of the Group increased by 59% only in 1997 (Daimler-Benz, 1997). Internationalization became a trend in this business as well.

- **Directly managed businesses.** These included the rail systems subdivision, where the alliance between Daimler-Benz and ABB (a supplier of technologies to vehicle manufacturers, railway operators and system integrators) maintained its global position as the leading and most complete rail system supplier, microelectronics, and diesel engines. All of them underwent significant improvements in the years before the merger with Chrysler (Daimler-Benz, 1997).

An element matching the two companies' interests can be found in the passenger cars and commercial vehicles divisions: the orientation towards emerging markets. About two thirds of the company's revenues were originated outside Germany already (table 6.1, below).

<table>
<thead>
<tr>
<th>Production Locations</th>
<th>Sales Organization Locations</th>
<th>Revenues (mil DEM)</th>
<th>Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>21</td>
<td>3,435</td>
<td>55,966</td>
</tr>
<tr>
<td>North America</td>
<td>10</td>
<td>655</td>
<td>19,190</td>
</tr>
<tr>
<td>South America</td>
<td>4</td>
<td>468</td>
<td>4,683</td>
</tr>
<tr>
<td>Africa</td>
<td>3</td>
<td>272</td>
<td>3,077</td>
</tr>
<tr>
<td>Australia/Oceania</td>
<td>1</td>
<td>186</td>
<td>1,044</td>
</tr>
<tr>
<td>Asia</td>
<td>7</td>
<td>931</td>
<td>7,672</td>
</tr>
</tbody>
</table>

*Table 6.1 - Daimler-Benz's Vehicle Operations by Area.*

The global strategy of Daimler-Benz called for a new direction though. The company was producing luxurious cars, of great quality, but priced much higher than comparable ones. If the goal was that of increasing shareholders value, and therefore increase the profitability of operations, then it needed to do something more. Schrempp’s idea was that of creating a niche in every market, reducing dependencies among cars. Thus he did not want to enter
the mass market, but was rather aiming at targeting people that were willing to pay a little extra in the mass market, in return for perceived quality and Mercedes’s name (Waller, 2001). In this way he was also securing the company from down auto cycles.

Instead of following the cost reduction tendencies spread in the automotive industry, Schrempp envisioned a different organization of production. Specifically, he thought it would be better to avoid sharing platforms between different lines, as he was sure that it would be better to have one for each. In this way quality would not risk to be compromised, and products would be the best around. Economies of scope were therefore neglected.

6.2.2 The American bulldog: Chrysler

Chrysler was born in the USA, with the goal of producing a revolutionary new cars in the 20s. In the intentions of its founders the products had to be affordable “luxury” vehicles known for their innovative and quality engineering. Their expectations realized, and the firm was labeled as Detroit’s engineering company. During its entire history Chrysler experienced many crises that significantly and negatively affected its profitability. It actually stepped close to financial bankruptcy several times (e.g. 1956, 1965 and 1993). With the support of its management team, and federal loan guarantees, it always managed to rise again and overcome these issues.

<table>
<thead>
<tr>
<th>Car sales</th>
<th>1997</th>
<th>1996</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car market share</td>
<td>$736,530</td>
<td>$832,633</td>
<td>$96,103</td>
</tr>
<tr>
<td>Truck sales</td>
<td>$1,567,258</td>
<td>$1,618,192</td>
<td>$50,935</td>
</tr>
<tr>
<td>Truck market share</td>
<td>21.7%</td>
<td>22.4%</td>
<td>-1.7%</td>
</tr>
<tr>
<td>Combined car and truck sales</td>
<td>$2,303,788</td>
<td>$2,450,826</td>
<td>$147,038</td>
</tr>
<tr>
<td>Combined car and truck market share</td>
<td>14.9%</td>
<td>15.9%</td>
<td>-1.0%</td>
</tr>
<tr>
<td>Minivans only</td>
<td>$518,445</td>
<td>-</td>
<td>N.A.</td>
</tr>
<tr>
<td>Minivan market share</td>
<td>44.4%</td>
<td>-</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

| U.S. and Canadian retail market: |
| Combined car and truck sales | $2,559,950 | $2,690,340 | $130,390 |
| Combined car and truck market share | 15.1% | 16.1% | -1.0% |
| North America:              |
| Combined car and truck sales | $2,649,542 | -       | N.A.    |
| Combined car and truck market share | - | - | - |
| World:                      |
| Combined car and truck sales | $2,886,981 | $2,958,800 | $71,819 |
| International shipments (outside North America) | $237,000 | $224,000 | $13,000 |

Table 6.2 - Chrysler's Sales Trends, 1996 and 1997.

In the 80s, despite the competition coming from foreign producers in the market threatening the industry together with the approaching overcapacity, Chrysler managed to avoid the negative consequences and instead launched its minivans. As of 1996
the company had a 47% share of the market, which could be reached also thanks to the acquisition of the Jeep brand name.

The firm was heavily focused on trucks, which accounted for about two thirds of Chrysler’s vehicle sales, while the remaining third was accounted for by cars. Among trucks, minivans were the most successful product in the portfolio. Table 6.2 shows the firm’s sales trends for 1996 and 1997.

6.2.2.1 Chrysler’s strengths

Chrysler was certainly known for its strengths. A first element is given by the fact it had a very short concept-to-market cycle. This refers to the time gap between the project development for a specific vehicle and the moment it reaches the market and is therefore ready to be sold. The development time for Chrysler went from 60 months in 1988 to 24 over the next 8 years (Bruner et al., 1998). This was made possible by the particular structure the company had adopted in those years in order to become more cost effective and therefore increase its net income. The most significant innovation for Chrysler here consisted in gathering all the engineers and designers assigned to a specific project on a single floor, together with representative from finance, marketing and purchasing, granting them extensive autonomy. In this way the process became much more convenient, since people were already working closely and did not need to go through slow procedures in order to communicate with one another. Also, having more autonomy, the people involved in the process could easily add more improvements to the product being built, without having to contact the higher levels within the hierarchy to ask for permission for every detail. This improved process obviously allowed the company to save money by wasting less time and fewer resources.

A further step in this direction, which testifies the success of the approach just described, was that of dismantling all the functional teams, and reassign them to specific product lines. In this way everybody was more focused on the line it was allocated to, avoiding that people got distracted from other issues. They created some sort of specialists for each line, and this included not only in engineers and design areas, but also in the other staff functions. It is possible to say that Chrysler assimilated more to the tendency in the market to economizing processes than Daimler-Benz did.
These procedures notably reduced development costs as well. A contribution to this result was given also by the new nature of relationships with suppliers. In a market where new competitors were approaching, and therefore the margins for profits were reducing, Chrysler was able to innovate once again, but this time in terms of suppliers. First of all, it reduced the number of suppliers it was working with. Following this trend, it offered them long-term contracts, and involved them more in the design process. They were also encouraged to make suggestions that could improve the cost structure of Chrysler through an initiative called SCORE (supplier cost reduction effort) (Kuhn, 1996). It was a project that called for the collaboration between the two levels of the productive chain, and brought immense savings: it allowed the company to save approximately $2.5 billion since its development to 1998 (Kuhn, 1996).

The American company also had very efficient plants, and very creative styling. It was extremely good at matching the preferences of its customers and creating products that appealed them. This was the case, for example, of the minivan. Chrysler was the pioneer in this segment, and kept its primate for a long time. Therefore, while other big companies survived through cutting costs, the firm was able to always introduce new models, and its line up was known as one of the most innovative in the industry.

6.2.2.2 International expansion

The international expansion of Chrysler started in the 90s, and was driven mostly by the Jeep brand, which was sold internationally. Despite that though, sales abroad only counted for 10% of the total, so there was still a long way to go before getting to the goal of becoming a global player. The company, as mentioned, was mainly operating in the American market, where it definitely was one of the biggest competitors and was keeping up the good work. The situation there was not so rosy, and it was time for the firm to find alternatives to escape the trap of overproduction, cost pressures and low profitability.

The targeted markets were therefore Latin America and the European market. As far as the former is concerned, the primary focus was certainly Venezuela (Bruner et al., 1998), followed by Argentina and Brazil. The costs for importing foreign goods there were quite high (between 60 and 70%), and against the tendency of other companies in the industry, Chrysler established factories there before competition.
Also the European market was interesting for the American company. Its presence there was very limited, as it held only 0.7% of the market. Furthermore, there were many strong competitors in the minivan segment, namely Ford and Volkswagen, whose sales represented one third of the total vehicle sales in Europe. The missing presence of Chrysler overseas was due to the lack of car models tailored for this market, and the fact it had only a thin sales network there.

6.2.3 The Deal: how it started

DaimlerChrysler’s deal was signed in 1998, but soon turned out to be a complete failure and more money was wasted rather than earned.

A consideration must be done as of the wrong premises to the deal. The circumstances behind it were not usual, and it is likely that they pushed the management of the two companies to make fast and inconsistent decisions. When Daimler first approached Chrysler to propose a deal, the American company was already experiencing a strong pressure coming from one of its shareholders, Kirk Kerkorian. Together with the former CEO of the company Lee Iacocca, he offered $4.58 billion to acquire the remaining 90% of equity and make the company private. Chrysler’s chairman at the time, Robert James Eaton, was completely sure approving this deal was not the right thing to do, as it would completely wipe out everything the employees had been working for. Since the merger with Daimler-Benz would definitely cut out Kerkorian and Iacocca from the deal, and it would allow the company to pursue many synergies, at least in the management’s plans, this seemed like a much more appropriate deal. In these circumstances, where human judgment was blinded by fear, the effects of a wrong valuation of synergies might have been even more devastating.

Another psychological element could be taken into account, as it might have had an impact on the final turn out of the transaction. Despite the fact that the merger was presented as a “merger of equals”, the deal was designed so that Daimler would detain 57% of the new entity’s stock and Chrysler the remaining 43%. The supremacy of the German manufacturer was being subtly confirmed by this agreement, and it might have generated a feeling of inferiority in Chrysler’s management. This ultimately led to the departure of many of the most influential leaders employed in the latter, which ultimately had very serious consequences on the success of the merger.
6.2.3.1 Synergies: a fast overview

In this section the different potential synergies coming from a successful deal will be listed. A deeper analysis will be made in the sections ahead, when number will be added to the case, a model used, and their final value calculated. On top of that, financial synergies will be neglected in this specific case, in order to stay within the boundaries defined for the length of this thesis.

It has been said that operational synergies can be divided into cost synergies and growth synergies. While the former are generated when net income increases as a consequence of a reduction in costs, the latters come from a better position achieved by the company, which allows it to increase its growth rate, or keep it on the same level but for a longer period. An increase in the return on investment is a growth synergy as well (Damodaran, 2005).

Before going any further, it is relevant to look at the actual situation, and see how the two companies could work together. The most important aspect here is given by the fact that they produced products that were not overlapping at all. As a matter of fact, Daimler-Benz was targeting at producing cars and heavy trucks, while Chrysler's success was in its minivans. Mercedes was actually one of the world's biggest producers of commercial vehicles, coming from its plants, situated in forty-three different countries around the globe. Despite that, the German company was actually said to have a problem, which was usually referred to by mentioning a pyramid. The top of it represented the market Mercedes was targeting. A limited segment of people that had enough money to afford the German quality and craftsmanship delivered in Daimler's products. This market was narrowing down though, and competition was becoming more and more fierce. Right below that segment, there was that of Chrysler. It was alimented by Jeep sales and the numerous pick-up trucks and minivans it commercialized. Finally, the markets of Asia and Latin America represented the bottom of the pyramid. Both companies wanted to carve into those markets, and this aspect is one of the elements around which the entire discussion about synergies revolves.

Starting by cost synergies, it is possible to distinguish different main categories, which will be then developed later in the paper, and discussed more thoroughly.

- R&D/Platforms. The very efficient way of designing and manufacturing things that Chrysler had implemented, could be somehow integrated into Daimler's best
practices. At that point in time, the latter was doing exactly the opposite, and keeping so many different platforms open, without generating economies of scale on any other side could be too costly. In turn, another benefit came from further knowledge transfer between employees. By getting in touch with Daimler’s, Chrysler’s employees could improve their technical capabilities and therefore reduce their warranty costs.

- Purchasing. Economies could be achieved in this category thanks to the much higher bargaining power gained through the deal. As the size of a company increases, its bargaining power compared to the other players in the economic background increase as well (Porter, 1979). By reaching broader boundaries and developing in countries where not many other players were present, Daimler-Chrysler could get more convenient prices from its suppliers. This aspect was also linked to the relationships with suppliers Chrysler developed in the latest years. Through a transfer of best practices, Daimler could do the same. An alternative would be, assuming it would not compromise the quality of its products, that of Daimler switching to some of the American producer’s suppliers.

As far as growth synergies are concerned instead, two main categories could be identified:

- Revenue Increase. As mentioned, one of the common objectives of the participants to the deal was that of expanding their sales in Asia and Latin America, markets that were particularly juicy at the time. Both companies, especially Chrysler, had also established production facilities in those areas, therefore that goal did not seem so hard to achieve. Specifically, while Daimler could produce very sophisticated cars, this was not what emerging countries needed. Income was growing, but it was still low; the infrastructures were not good enough to justify such expenditures; public transportation was still more convenient. Chrysler instead, knew how to cut costs, and was very good at matching its customer’s preferences. As a result, the collaboration between the two could grant both the benefits of approaching a growing demand. If industrialized countries are taken into consideration instead, as Chrysler was not so strong in Europe, and Daimler in the USA, and as a consequence of the fact there was no overlapping in terms of products or targeted customers, by joining their efforts the companies could strengthen their positions there.
• Distribution/Dealership. This category of growth synergies deals is strictly related to the previous one. By sharing distribution networks, the two companies could reach different markets faster, and consequently increase the number of units sold around the globe.

6.2.4 How it ended

The nine-year merger between Daimler and Chrysler was dissolved in 2007, and the former was sold off for $7.4 billion, a fifth of the value it was bought for in the first place. Jürgen Hubbert, a member of the board of the merged company, declared that they knew exactly what went wrong, as they had “one company, one vision, one chairman, and two cultures”. The cultural elements have not really been taken into consideration when planning the integration strategy for the two firms. The synergies projected within the boundaries of purchasing and R&D could not be achieved as a result of the reluctance of the German employees to share anything with the American counterparty. This problem was of course emphasized by the cross-border nature of the deal, which was absolutely underestimated.

On the side of revenues and distribution instead, the newly integrated company never actually managed to pursue the plans it had concerning the expansion in Asia and Latin America. Schrempp, Daimler’s CEO, was even considering to buy some interests in Nissan, in order to fully grasp the potential coming from the eastern markets, but was promptly stopped, seen the bad way the merger with Chrysler was being handled already. On top of that the competition in the American market was fierce, especially in the minivan industry that Chrysler was dominating ahead of the merger. Japanese manufacturers approached the North American market, selling even cheaper products than the local leader.

In conclusion, the difficulty level in the integration of such a company has been overlooked since the very beginning of negotiations, which mined the entire development of a successful company. The DCF approach utilized for the valuation of synergies had not taken into account the risks linked to the materialization of synergies.

7 Synergies Valuation

In this section of the paper the actual valuation of synergies is provided. First of all, the method chosen will be exposed, together with the reasons that led to its choice. As it has
been said that under specific circumstances synergies can be considered real options, a valid approach for valuating them will be used. Secondly, an analysis of the specific synergies forecasted within the Daimler-Chrysler merger will be carried out. Finally, the obtained results will be discussed and conclusions about the suitability of real options as valuation tool for M&As will be made.

7.1 The valuation method

Several different approaches are being used for the valuation of RO. They are usually borrowed from financial options valuation, and then applied in the real options context. They usually rely on some basic common elements, such as the price of an underlying financial instrument, which can be considered the starting point for pricing an option.

The most widely used method is that of binomial lattices, a method proposed by Cox, Ross and Rubinstein in 1979 (Cox, et al., 1979). Through that, the description of the underlying asset over a determined period of time is provided. Specifically, this model assumes that the price of the underlying activity either increases or decreases by a defined amount, in every period. This characteristic makes it easily extendible to more than one period. More generally, considering a definite period of time \([t, t+h]\), we can imagine an underlying asset, whose price equals \(S\), paying out dividends at a constant rate \(D\), which are then reinvested in more units of the asset itself. In this scenario, the value of the underlying asset can assume two different values at time \(t+h\): it can either move up by a factor \(u\), to \(uS\), or down by a lower factor \(d\), equaling \(dS\). The value of the underlying asset at time \(t+h\) is then calculated taking into account the two factors, and the ultimate value of the call (put) option at time \(t=0\) is given by the maximum value between the asset price at time \(t\) (exercise price) and the exercise price (asset price at time \(t\)). An evolution of the single period binomial model is given by the multi-periodic binomial model, which allows valuating American options as well, in the context of financial options.

Another very famous and spread method for valuing real options is the Black-Scholes model. This is an evolution of the binomial model, as its basic assumption is that the interval considered for the valuation can be divided into an indefinite number of subintervals. As the number of subintervals increases, their size decreases, and the price of a European call
option with a given strike price converges to a fixed value. This limit price is that given by the Black-Scholes formula.

The biggest limitation to the application of such approaches to real options can easily be spotted. These methods rely on the basic assumption that there is a financial asset that can be freely traded in the market. When applied to RO then, it means that in order for these methods to be valid there needs to be a financial asset that exactly resembles the cash flows and milestones of the project that is being valued in that specific case. It can be easily seen that this is particularly rare, and almost never happens. As a consequence, none of these approaches has been chosen for the valuation of synergies, whose cash lows replication is even more complicated and difficult, given the higher level of uncertainty that characterizes them. Therefore, in these circumstances the inputs needed for the approaches utilized for financial options are impossible to generate.

7.1.1 The chosen approach

In order to avoid the pitfalls of the techniques mentioned above, a third method is going to be used: the Datar-Mathews method. Vinay Datar, Associate Professor of Finance at Seattle University, and Scott Mathews, Technical Lead of Computational Finance and Stochastic Modeling in Analytical Modeling and Simulation, first theorized this for Phantom Works in the Boeing Company (Datar, and Mathews, 2004). This method uses the information available from standard net present value analysis, as it uses the distribution of the project’s value, the discount rate associated to it, the investment level chosen by the company and the risk-free rate. By adjusting the discount rate to take into account the underlying risks of the project this method can be considered algebraically equivalent to the Black-Scholes one (BS). If we consider the realization of synergies as a project, as the commitment of time and resources to it depends on managerial decisions, it is easy to see how the D-MM (Datar-Mathews Method) can be applied in that context and provide insightful information for decision-making.

It is possible to identify three separate steps in the application of this model:

- **Step 1**: the discounted distribution of benefits from the synergies at T=0 is determined using the WACC as a discount rate;
• **Step 2:** the threshold at \( T=0 \) is identified using the PV of the exercise price discounted at the risk-free rate (in the case of synergies, this is represented by the costs needed to achieve those synergies)

• **Step 3:** the average payoff at time 0 is found, and the minimum payoff is set to 0.

The final ROV (real option value) for a project is found as:

\[
\text{Real Option Value} = \text{Average} \left[ \text{MAX}\left( \text{operating profits} - \text{launch cost}, 0 \right) \right]
\]

In the case of synergies valuation, launch costs can be identified in the costs needed in order to get the right to realize them, i.e. the price paid for the acquisition. The different steps will be analyzed more in detail when paired to the Daimler-Chrysler case in the next sessions. There, graphical overviews and numerical examples will be given as well.

Another important element of the technique is that Monte Carlo simulation is used for the generation of the different distributions. Specifically, within step 1, three scenarios need to be created, a pessimistic, a most likely and an optimistic one. Their outcomes represent the corners of a triangular distribution, which is created through a Monte Carlo simulation (Datar, and Mathews, 2007), as shown in figure 7.1. The likelihood of an outcome to materialize is represented by the area behind the function. This method provides a way to translate the uncertainty linked to the different scenarios, as it takes successive draws from all the input variables distributions, with the most frequent trials nearest to the most-likely values.

Then the NPV value of the operating income stemming from the synergies achieved is calculated, based on each different trial, and its distribution is simulated as well. This is calculated after the appropriate discount rate is determined. Applying an observable discount rate then, the real options approach is more tightly linked to the capital markets. This allows for the resulting profit and loss calculations to be on par with the way stakeholders might perceive the value of the same business opportunities represented by the merger. All these steps lead to the identification of the real option value at time 0.
There are various reasons why this method has been chosen for the purpose of the paper. The main point is given by its transparency. This is particularly important in a context where a huge amount of money is into play, and the circumstances needed by a correct valuation based on BS cannot be generated. The simplicity of the method then allows for the possibility of valuating situations that are more complex, granting a more accurate result than any other approach mentioned in the context of RO (Datar, and Mathews, 2004). A further strength can be identified in the applicability of the model. It essentially mixes NPV and RO valuation, providing a more complete approach. As companies generally use the NPV approach when valuing synergies, the fact that is still included in the new proposed approach might push them to use the alternative technique instead, as it is only an evolution of the status quo. On top of that, a very good exemplification of the possibility of implementation of the D-MM in a corporate reality is given by the fact it was developed through a collaboration between the academic world represented by Datar and the corporate one of Mathews (Datar, and Mathews, 2007).

7.2 Plugging in the Numbers

In the following section, the D-M approach will be implemented with regards to the Daimler-Chrysler merger of the late 1990s. Broadly speaking, the next different steps will be taken:

- Three scenarios for the synergies will be created;
- Their distributions will be determined;
- The value of the outputs will be discounted to time 0, and only the relevant outcomes will be observed;
- The value of the real option embedded in the synergies will be calculated.

Once the numerical part will be completed, conclusions will be made and their implications for further research discussed.

7.2.1 Step 1: Scenario Creation and the Distribution of Benefits

The D-MM approach requires the creation of three different scenarios: a pessimistic, most likely and optimistic scenario. Their outcomes will be modeled through a Monte Carlo simulation for the 5 years following the acquisition, i.e. from 1999 to 2003. This choice was made accordingly to the choices of Daimler’s management when announcing the merger in
the first place, and forecasting the potential synergies. Once the main variables they depend on will be set, a triangular distribution of the different scenarios will be created for each year, where the corners respectively represent the worst, most likely and best case outcome. A graphical example is given in figure 7.1, above.

In order to set the different parameters for scenario creation, several of the analysts and company reports published around the announcement date have been analyzed (Melich, and Hirth, 1998; Casesa et. al., 1998; Buckland, 1998; Melich, Girsky, 1998; DaimlerChrysler, 1998). The inputs for the simulation and the final calculation of the ROV (real option value) are the potential synergies and the integration costs, whose application will be discussed later.

In an attempt to better understand how the different forecasts work it is relevant to first analyze more into detail what the synergies mix was expected to be. This element will be common to all the scenarios, where what will change will be the value of the realized synergies, within each component of the mix. A general distinction of the synergies has already been made, but the discussion continues in the next sessions. There they will be classified in order to match the model, in order to better define the inputs for scenario creation. Financial synergies have not been included in the analysis, as easier to forecast, and not as uncertain as cost and growth ones. Given this, the final value of synergies should not be so different from the case with financial synergies.

The cost and growth synergies categories identified above can be reduced to three by combining the increase in sales coming from the expansion in new markets, and the increase in revenues coming from the improvements in the distribution network. The latter case assumes particular relevance for Chrysler, as it will be explained below. The resulting categories, representing the elements included in the synergies mix can be classified as:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Motors</td>
<td>8776</td>
</tr>
<tr>
<td>Ford</td>
<td>6943</td>
</tr>
<tr>
<td>Toyota</td>
<td>4843</td>
</tr>
<tr>
<td>Volkswagen</td>
<td>4260</td>
</tr>
<tr>
<td>Fiat</td>
<td>2865</td>
</tr>
<tr>
<td>Chrysler</td>
<td>2887</td>
</tr>
<tr>
<td>Nissan</td>
<td>2832</td>
</tr>
<tr>
<td>Peugeot Citroen</td>
<td>2106</td>
</tr>
<tr>
<td>Honda</td>
<td>2037</td>
</tr>
<tr>
<td>Mitsubishi</td>
<td>1912</td>
</tr>
<tr>
<td>Renault</td>
<td>1909</td>
</tr>
<tr>
<td>Suzuki</td>
<td>1834</td>
</tr>
<tr>
<td>Hyundai</td>
<td>1243</td>
</tr>
<tr>
<td>BMW</td>
<td>1196</td>
</tr>
<tr>
<td>Daimler-Benz</td>
<td>1133</td>
</tr>
</tbody>
</table>
• Research and Development (R&D), which was predicted to represent between 30 and 35% of the total value of synergies;
• Purchasing, representing the same quota as R&D;
• And finally Revenue and Distribution, totaling between 25 and 30% of the absolute value of synergies.¹

Aside from synergies, which by definition represent an increase in value, another input that needs to be taken into consideration and that might substantially reduce the potential for synergies is represented by integration costs. The importance of integration has been discussed in several sections above, and it assumes particular relevance in the context of an oversea merger like that of Daimler and Chrysler. It is often difficult to make such a deal work when the companies operate in the same country, therefore it must be even more complex when the companies conduct operations in different continents. Furthermore, the merger created the fifth largest player in the industry in terms of units sold, as can be seen in table 7.1, therefore the challenges were even greater. With a combined number of 3,602,000 units sold, the new entity positioned itself ahead of Fiat (Casesa, et al., 1998).

The human factor is fundamental when dealing with the realization of synergies (Schroeder, 2012; Lundqvist, 2012). Consequently a company needs to take into account the expenses coming from making sure the best premises for the materialization of synergies are into place. This category includes all the steps required to integrate the two companies and make sure that the best conditions for combining operations are present. This includes for example all the necessary procedures to joint plants, corporate functions and eliminate overlapping activities, but also activities that bring the different organizational cultures together in an effort to grant a working and efficient knowledge transfer between the companies involved (for a more detailed overview of the challenges characterizing integration, refer to figure 3.2). These costs can increase in a situation where integration turns out to be more difficult. This could happen for instance when the transaction involves two entities that are completely different from each other, or when closing down a plant in order to reduce the overlapping of operations turns out to be more expensive than forecasted as a consequence of the labor regulations existing in that country.

¹ The percentages presented here are the ones identified by Management at the announcement date (DaimlerChrysler, 1998). They will not necessarily be maintained in the pessimistic and optimistic scenarios.
Through the Monte Carlo simulation then, for which the add-in for Excel @Risk has been used, the values of the R&D, purchasing and revenues and distribution categories of synergies has been simulated. On top of that, the amount of integration costs has been simulated for each trial as well. The difference between the positive values of synergies, if realized, is then offset by that of the integration costs.

Now that the premises of the analysis of synergies have been discussed, it is time to look at the different scenarios created, and their specific assumptions.

7.2.1.1 The Most Likely Scenario

As mentioned above, the forecasts made by DaimlerChrysler in terms of achievable synergies at the deal’s announcement have been referred to as conservative by many analyst reports (Melich, and Hirth, 1998; Casesa et. al., 1998; Buckland, 1998; Melich, Girsky, 1998; DaimlerChrysler, 1998). Consequently, these forecasts have been appointed in the analysis as the outcomes the firm could expect in the most likely scenario, at least as far as the synergies value is concerned. The discussion about integration costs is slightly different, and will be touched upon later in this section.

In order to better understand how DaimlerChrysler’s estimates were made and where they come from, a deeper analysis of synergies and their sources is needed. Specifically, it is important to clarify that the different sources of synergies will be the same in every scenario, and what will change will only be the value of the materialized synergies per category, per scenario. This is a simplification that had to be made, given the limited size of this paper. The different drivers of synergies are:

- **R&D.** As a stand-alone company Daimler-Benz had a much stronger Research & Development division, which Chrysler could draw from. Economies on engineering development on new models and potential standardization of the production and assembling, including the reduction of the number of platforms utilized, represent some of the achievable improvements. By increasing the specialization and efficiency of these practices, the joint company could substantially reduce its spending.

- **On the other side,** Chrysler had successfully conducted a reduction of the number of platforms used, which led to broad savings. Different staff groups were created based on the different lines being produced, which allowed the company to reduce the time
spent on designing and launching the products, making the teams more focused and therefore productive. Daimler could learn from it too.

Sharing technologies would lead to significant improvements as well. Both companies had development programs for diesel engines, electric cars and the fuel cell technology, among other things at the moment of the transaction. Reducing redundancies here would be a great start in achieving economies.

- Purchasing. The combined purchasing of the two companies equaled around $60 billion, according to the companies (Casesa, et al., 1998). This area is particularly relevant when it comes to knowledge transfer, as Chrysler’s expertise is fundamental. The SCORE program described above and implemented by the American company allowed it to realize $1.7 billion in the four years following its first implementation. By granting a continuous and efficient transfer of knowledge between Chrysler’s and Daimler’s employees, and by making sure that processes are fully integrated between the two, the German company could easily adopt this approach as well.

Another important point within this synergy category is given by the fact that the company became a much bigger player in the industry, and its increased purchasing power would allow it to get better terms with suppliers. This aspect becomes even more relevant and the potential savings higher, when looking at the top 10 suppliers of the two companies (Colli, and Shields, 1998). They had three in common, and two of them were among the ones with the highest ranking in terms of turnover, as shown in the table below. With them the positive effects of an increased purchasing power might be even higher.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Chrysler</th>
<th>Daimler</th>
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<tbody>
<tr>
<td>1</td>
<td>Magna International</td>
<td>Robert Bosch</td>
</tr>
<tr>
<td>2</td>
<td>Johnson Controls</td>
<td>Magna International</td>
</tr>
<tr>
<td>3</td>
<td>Dana Corp.</td>
<td>Johnson Controls</td>
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<tr>
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<td>Textron Automotive</td>
<td>Mannesmann</td>
</tr>
<tr>
<td>5</td>
<td>American Yazaki</td>
<td>Wilhelm Karmann</td>
</tr>
<tr>
<td>6</td>
<td>New Venture Gear</td>
<td>Lisa Draexlmaier</td>
</tr>
<tr>
<td>7</td>
<td>Lear Corp.</td>
<td>Lear Corp.</td>
</tr>
<tr>
<td>8</td>
<td>TRW Inc.</td>
<td>Behr GmbH</td>
</tr>
<tr>
<td>9</td>
<td>Denso Corp.</td>
<td>ITT Automotive</td>
</tr>
<tr>
<td>10</td>
<td>Goodyear</td>
<td>Thyssen AG</td>
</tr>
</tbody>
</table>

Table 7.2 - Chrysler and Daimler Top 10 Suppliers (ranked by turnover).
Within the purchasing category, further savings were expected from the activities of sharing components, engines and transmissions, for the development of new models in the first years of operation. This would increase the economies on purchasing, allowing the new entity to ask lower prices to suppliers.

To conclude, the company announced it would save between 0.5% and 0.8% of the combined expenses for purchasing in this category, and that number represents the most likely scenario in the following analysis.

- Revenues and Distribution. Within this group, DaimlerChrysler expected to achieve an increase in operating income of around $420 million. This positive outcome was justified by different sources. On the revenue side, as Daimler could increase its presence in the USA, and Chrysler in Europe instead, the new entity could also benefit from starting to produce new cars matching the preferences and needs of customers in the emerging markets. Despite the challenges such an expansion bears, the benefits could still be very high. In order to make this expansion possible, a strong emphasis was put on the improvement of Chrysler’s distribution network. It held only 0.7% of the market share in Europe at the time of the merger, and Daimler Chrysler recognized the importance of choosing the right skilled and reliable business people to invest in the franchise for an increase in distribution. Daimler-Benz had one of the strongest dealerships in Europe, and this represented one of the key strengths in the brand image. Chrysler would then be able to access these professional Mercedes dealers as potential owners of the Chrysler franchises. Thanks to Daimler backing up this process, the merger was expected to lead Chrysler to increase its market share in Europe.

![Figure 7.2 - European Dealer Outlets.](attachment:image.png)
The same was argued about the American company tapping into the commercial truck distribution system of Daimler in Latin America, an opportunity that could be exploited quickly, given the fact that Chrysler was operating at full capacity in Mexico, but needed to start up a new plant in South America (Casesa, 1998).

From the value of synergies, it is necessary to deduct integration costs. As this is an uncertain amount in the pre-merger and valuation phases, that will be simulated as well. Specifically, in the most likely scenario, this has been calculated as 14% of the deal value. This choice was based on a study by EY, which concluded that on average that is what companies spend in their post-merger integration. In order to simplify the analysis, it has been assumed that the costs would be equally spread over the first 5 years after the deal (1999-2003). As the deal value was $36 billion, the annual integration cost for the first 5 years, in the most likely scenario, has been rounded to $1 billion.

7.2.1.2 The optimistic scenario
As the forecasts made by DaimlerChrysler were perceived to be too conservative, the assumptions for the optimistic scenario have been determined on a different basis. Specifically, some of the data comes from the comparison between this merger, and that of BMW and Rover of the early 90s. The change from the base case can be justified in the following way:

- **R&D.** Daimler had a better R&D process than Chrysler, but the latter knew how to carry it out in a cheaper way. Per car, it spent an average of 3% of its revenue, while the German company spent around 4.6% (Harbour, 1998). This can be justified by the fact that Daimler’s cars were much more sophisticated than the ones Chrysler produced, and therefore required a more complex and costly R&D process. In the best case scenario though, I have assumed that Daimler, thanks to the knowledge sharing between the two companies, could save up around $580 million by reducing its R&D costs per car to 3.5% of the value.

- **Purchasing.** BMW and Rover merged together managed to save about DM 700 per car in the first two years of joint platforms. If we assume in the best case that
DaimlerChrysler will achieve the same results per car, then it would save an estimated $1.2 billion annually, only in this category.

- Revenues and Distribution. If Chrysler, exploiting Daimler’s distribution network, managed to reach the European average of 131 units sold per outlet every year, and it increased its outlets to 1200, this would translate in an increase of its sales in that area to 157,000 units per year. I will assume 1200 is the highest achievable number of outlets for Chrysler. Mercedes, as the company making this increase in distribution possible, cannot be overtaken in that by the American firm (Daimler had 1304 outlets in Europe in 1997, table 6.3). This number would translate in an increased in income of around $1 billion annually.

As far as integration costs are concerned instead, it seems fair to assume that a best scenario is characterized by lower integration costs than the most likely one. As a consequence it has been assumed that integration costs would just equal half of the amount they would represent in the latter scenario, therefore $500 million per year.

7.2.1.3 The Pessimistic Scenario

The assumptions for the worst case are slightly more intuitive. Specifically, it will be assumed that this is characterized by a value of synergies that equals 0. As a matter of fact though, efforts would be made in such circumstances, and even consistent ones, but no value would be created at all.

Only negative cash flows would be registered then, and they would equal 21% of the deal value, therefore $1.6 billion per year over the 5-year time period analyzed.

A more precise justification of the missed materialization of synergies is the following:

- R&D. Savings are not really possible as a consequence of the complementarity of products. Having completely different cars on their plates, the two companies could find it difficult to integrate their processes. Furthermore, it might be difficult for Daimler to further reduce its R&D costs, as a big part must be due to the sophistication and quality of its products. Having different platforms for different
products, and being set that way since the beginning, Daimler could have bigger difficulties in adopting the more standardized Chrysler's approach. Knowledge transfer could become even more difficult due to the different cultures embedded in the companies.

- **Purchasing.** Again, the fact products are not overlapping causes the common suppliers to keep producing the same pieces that were supplied before. As a consequence, there would not really be any significant saving for them, which would make them reluctant to reduce the prices for the newly merged entity.

- **Revenues and Distribution.** The impossibility of materializing synergies in this area could be due to two main elements. The first one concerns the planned expansion in emerging countries: the challenges companies face there have been broadly analyzed in the previous sections, and the risks associated with such plans were significant, particularly at that point in time. The potential expansion of the Chrysler brand in Europe, and that of the Mercedes one in the USA instead represent the second element. Both these markets have been described as mature, therefore changing the market share of a company in such a phase of the industry lifecycle is not as easy as it might seem.

A further factor influencing the profitability within these boundaries concerns the increase in distribution the companies were planning to achieve. The brands were perceived in a completely different way by customers, with Daimler being synonym of craftsmanship and Chrysler representing the American easygoing attitude. Therefore there was a high likelihood that Daimler's original distributors would not be willing to sell products coming from the new entity including Chrysler as well.
7.2.2 The Simulation

Once the scenarios have been built, and the savings in operating income and the integration costs established for the five years, the simulation has been carried out through the add-in for Excel @Risk. In order to do that, the inputs and outputs of the simulation have been determined.

The input variables are represented by the increase in operating income, given by the value generated by the synergies in R&D, purchasing, and revenues and distribution, but also by the integration costs.

The free cash flows coming from these inputs, whose PV represents one of the outputs of the simulation, have been calculated as shown by Bruner in his book Applied Mergers and Acquisitions (2004). Some assumptions needed to be made in order to find these values. First of all, it was assumed that in any of the three scenarios, the cash flow would keep growing at the inflation rate, which equals 2.5%. This number was then used in order to calculate the terminal value for the company (DaimlerChrysler, 1998), and the present value of the free cash flows calculated this way has been discounted to 1998, the year of the merger, using the company’s WACC (see appendixes for further details). The NPV distribution has been calculated as well, and is included in the appendixes.

The assumptions for the different inputs can be seen in the table below, distinguished by scenario they pertain to.

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<tr>
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</table>

*Table 7.3* - Inputs to the Monte Carlo Simulation (in $ million).
Successive random draws from all the operating income and integration costs distributions have been taken, with the most frequent draws nearest the most-likely values. Each draw represents then a plausible scenario and is calculated through Excel, leading to a comprehensive profit/loss analysis for that specific scenario example. In this analysis 2000 trials have been realized, as recommended for final results (Datar, and Mathews, 2007). For an overview of the triangular distribution generated for the inputs, refer to the appendixes. Once the present value of the cash flows coming from the synergies has been calculated, its distribution looked like this.

![Figure 7.3 - Present Value Distribution of the Free Cash Flows from Synergies.](image)

As mentioned above, the present value has been calculated by discounting the free cash flows per year at the company’s WACC. By applying an observable discount rate, a synergies valuation carried out this way is grounded in the reality of capital markets, placing these calculations on par with how shareholders might perceive the value of the merger itself (Datar, and Mathews, 2007).

What determines the real option value though is the net present value of the cash flows, and the former can be interpreted as the appropriately discounted average net free cash flow, assuming that the deal is not undertaken if a loss is forecasted, and therefore a negative NPV achieved. Therefore the successful outcomes in which the discounted cash flows exceed the payment made by Daimler for the acquisition of Chrysler’s shares are represented by the
part of the distribution on the right of $36 million in figure 7.3. The area on its left instead consists of draws in which the price paid is anticipated to be higher than the value generated by synergies, and would therefore lead to a NPV lower than 0.

At this point it is possible to calculate the value of the synergies as real options. The Datar-Mathews method has the following formula:

\[
Real\ Option\ Value = \text{Average}[\max(PV\ of\ free\ cash\ flows - \text{deal\ value}, 0)]
\]

Using Excel, the final synergies value calculated this way equals $1.835 billion. This number is then divided by the number of Chrysler's shares, in order to find the value of synergies per share. The latter equals $2.83 per share (648.4 million shares outstanding at announcement date).

A more intuitive calculation proposed by this method simply links the probabilities of the different outcomes to the actual outcomes, calculating some kind of expected value from synergies. Under these circumstances, the probability of creating value is 32%. This means that there is a probability of 32% that the merger will generate a positive NPV. As a consequence, the ROV can be calculated as:

\[
Real\ Option\ Value = \text{Risk\ Adjusted\ Success\ Probability} \times (Benefits - Costs)
\]

If the risk adjusted probability of success is 32%, and the discounted mean value of the successful outcomes is $1,826.79 thousands, the value of synergies per Chrysler share is $2.82 over and above the premium paid by Daimler.

8 Conclusions and Future Research

Using an ROV approach, the value of synergies per Chrysler share is found to be $2.82 over and above the premium, which is significantly different than the value obtained using ordinary methods, i.e. $53.96 per share (Bruner, 2004). Also incorporating the premium paid into Bruner's results yields synergies of $39.16 per share using a DCF method, still vastly higher than that obtained with an RO approach. The fact that RO incorporate uncertainty was particularly relevant here, given the many sources of uncertainty with regards to a cross-national merger. This approach does not only incorporate the downside risk coming from the planned investments in uncertain and not so fruitful industries only,
but also the upside potential coming from a too conservative most-likely scenario. On top of that, this approach also made it possible to take into consideration the impact of integration costs, the amount of which is absolutely uncertain, and can easily be increased or reduced by the company involved as circumstances change. Thus, it seems that if only revenue and cost synergies are taken into consideration, as by the assumptions outlined, then the deal did not look very promising. Value creation can be expected only when the expected value of synergies is positive. As integration costs come into play in this specific analysis, the value of synergies per share is very close to zero, which might lead to the decision of abandoning the project, as the outlook is not so good. The result obtained here definitely looks more in line with the way the merger turned out. Thus, a more conservative value like the one obtained here might have led the management of Daimler to reconsider the deal.

One limitation of the model comes from the fact it required the amount of money spent in order to undertake a project to be subtracted from the present value of operating income coming from the project itself. In a synergies perspective, this has been interpreted as the need to subtract the money spent on the deal ($36 billion) from the present value of the free cash flows stemming from the interaction of synergies and integration costs. By doing this all the instances where the present value of the free cash flows is lower than the deal value are eliminated, as it is assumed they would not be optimal for the shareholders. This might not be necessarily the case though, as the latters' expectations could be different, and subtracting this value might lead to a ROV that is too low.

Another limitation of the analysis at hand is that financial synergies have been excluded. This means that the value of financial synergies should complement the real option value as well, which could notably increase the final value of the option. However, as the expected financial synergies were expressed as being negligible at the time, including them in the value of synergies per share would not have altered the final result, i.e. the value deduced through a ROV approach being significantly lower than that of a DCF approach.

Finally, another limitation concerns the actual applicability of the real options method. The value generated through it is often presented as something coming out of a black box. This leads to its results being used in an inferior way if at all, as it is typically not fully understood.
by management (Collan, 2011). Proper organizational tools are also necessary in order to implement a ROV approach (Krychowski, and Quélin, 2010).

Following the conclusions in terms of feasibility of the deal and synergy valuation, and the limitations of the real option approach, further research could focus on a better examination of the application domain of RO and the type of analysis that should be performed. Furthermore, analyzing under which specific conditions firms can achieve a successful implementation of RO would be worth additional attention. In the latter case, the fact that RO are not implemented correctly might still lead to a wrong valuation of synergies, and could therefore not prevent the management from making wrong decisions, which make shareholders worse off.

To conclude, if applied correctly RO can be a good tool for taking into consideration the uncertainty characterizing the materialization of synergies. If the correct assumptions are made and the tool is used appropriately, it provides a sound bases for decision-making. As a consequence, it should be integrated in the practice of valuating a target when contemplating a merger or acquisition.
9 References


10 Appendixes

10.1 Appendix A

Assumptions to the case discussion.

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<th>Scenarios Assumptions</th>
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## 10.2 Appendix B

Triangular distribution of the inputs to the Monte Carlo simulation.

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<td>RiskTriang(Assumptions!H14;Assumptions!H13;Assumptions!H12)</td>
<td>0</td>
<td>43584</td>
<td>78646</td>
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10.3 Appendix C

Outputs of the Monte Carlo simulation and free cash flows from synergies.

<table>
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<tbody>
<tr>
<td>Pretax Cost Savings</td>
<td>1,393.3</td>
<td>1,854.1</td>
<td>2,528.6</td>
<td>2,581.8</td>
<td>2,636.3</td>
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<tr>
<td>Expected Inflation Rate</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
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<tr>
<td>Growth rate of FCF (nominal), in perpetuity</td>
<td>2.5%</td>
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<tr>
<td>Ongoing Investment/Savings</td>
<td>2.0%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>2.0%</td>
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</tr>
<tr>
<td>Tax Rate</td>
<td>38.5%</td>
<td>38.5%</td>
<td>38.5%</td>
<td>38.5%</td>
<td>38.5%</td>
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</tr>
<tr>
<td>Pretax Cost Savings, current $</td>
<td>1,428.2</td>
<td>1,948.0</td>
<td>2,723.0</td>
<td>2,849.8</td>
<td>2,982.8</td>
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<tr>
<td>Tax Expense</td>
<td>549.8</td>
<td>750.0</td>
<td>1,048.4</td>
<td>1,097.2</td>
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<tr>
<td>After-tax Cost Savings</td>
<td>878.3</td>
<td>1,198.0</td>
<td>1,674.6</td>
<td>1,752.6</td>
<td>1,834.4</td>
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<tr>
<td>Integration Costs</td>
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<td>1,008.0</td>
<td>1,008.0</td>
<td>1,008.0</td>
<td>1,008.0</td>
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</tr>
<tr>
<td>Divestment associated with savings</td>
<td>-</td>
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<tr>
<td>Subtotal</td>
<td>-129.7</td>
<td>190.0</td>
<td>666.6</td>
<td>744.6</td>
<td>826.4</td>
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<tr>
<td>Terminal Value</td>
<td>-</td>
<td>43,584.5</td>
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</tr>
<tr>
<td>Free Cash Flow</td>
<td>-129.7</td>
<td>190.0</td>
<td>666.6</td>
<td>744.6</td>
<td>44,410.9</td>
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<tr>
<td>WACC</td>
<td>8.7%</td>
<td>8.9%</td>
<td>9.1%</td>
<td>9.2%</td>
<td>9.2%</td>
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<tr>
<td>PV of free cash flows</td>
<td>30,055.8</td>
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<tr>
<td>NPV</td>
<td>-5,944.2</td>
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<tr>
<td>Number of Chrysler Corporation Shares</td>
<td>648.4</td>
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<tr>
<td>Value of Synergy per Chrysler Share</td>
<td>2.8</td>
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</table>

WACC calculation (Source: Bruner et al., 1998)

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<tr>
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<th>1998</th>
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<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
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<tr>
<td>Debt/market equity</td>
<td>63.5%</td>
<td>63.7%</td>
<td>52.5%</td>
<td>43.1%</td>
<td>35.0%</td>
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<tr>
<td>Relevered beta</td>
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<td>1.0</td>
<td>1.0</td>
<td>0.9</td>
<td>0.9</td>
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<tr>
<td>Cost of Equity</td>
<td>11.8%</td>
<td>11.8%</td>
<td>11.5%</td>
<td>11.3%</td>
<td>11.1%</td>
<td></td>
</tr>
<tr>
<td>WACC</td>
<td>8.7%</td>
<td>8.7%</td>
<td>8.9%</td>
<td>9.1%</td>
<td>9.2%</td>
<td>9.2%</td>
</tr>
</tbody>
</table>

The WACC for 2003 has been assumed to equal that of 2002, as a consequence of the lack of projected data for that year.
10.4 Appendix D

Distribution of the PV and NPV of the free cash flows from synergies.
### Simulation Data

<table>
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<tr>
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<tbody>
<tr>
<td>Minimum</td>
<td>1,583.2</td>
<td>-34,416.8</td>
<td>25.6</td>
<td>45.1</td>
<td>46.0</td>
<td>49.8</td>
<td>82.7</td>
<td>516.7</td>
<td>509.9</td>
<td>513.2</td>
<td>513.2</td>
<td>513.2</td>
<td>511.9</td>
<td>1,419.6</td>
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<tr>
<td>Maximum</td>
<td>53,133.3</td>
<td>17,133.3</td>
<td>2,737.1</td>
<td>3,466.0</td>
<td>4,571.4</td>
<td>4,621.0</td>
<td>4,688.9</td>
<td>5,019.1</td>
<td>1,496.6</td>
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<td>1,502.3</td>
<td>1,510.7</td>
<td>778,321.1</td>
<td>43,584.2</td>
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<tr>
<td>Mean</td>
<td>30,055.7</td>
<td>5,944.3</td>
<td>1,393.3</td>
<td>1,854.1</td>
<td>2,582.8</td>
<td>2,636.3</td>
<td>1,080.0</td>
<td>1,080.0</td>
<td>1,008.0</td>
<td>1,008.0</td>
<td>1,008.0</td>
<td>1,008.0</td>
<td>1,008.0</td>
<td>43,584.2</td>
</tr>
</tbody>
</table>

### Output Values

- **Errors**: - - - - - - - - - - - - -
- **Mode**: 31,882.1 -4,117.9 1,430.1 2,034.6 2,9960 3,133.8 1,005.5 1,005.5 1,020.8 995.2 1,015.6 51,810.2
- **5% Perc**: 10,776.8 -25,223.2 439.4 597.4 826.2 846.5 864.5 663.2 662.7 663.0 663.1 662.9 14,243.8
- **10% Perc**: 14,628.0 -21,372.1 623.7 847.2 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **15% Perc**: 17,843.5 -18,156.5 763.0 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **20% Perc**: 20,431.8 -15,568.2 882.1 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **25% Perc**: 22,330.4 -13,669.6 985.7 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **30% Perc**: 24,428.9 -11,571.1 1,080.5 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **35% Perc**: 26,327.6 -9,672.4 1,167.0 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **40% Perc**: 27,945.1 -8,055.0 1,167.0 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **45% Perc**: 29,496.6 -6,503.4 1,167.0 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **50% Perc**: 31,130.9 -4,869.1 1,167.0 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **55% Perc**: 32,693.5 -3,306.5 1,167.0 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **60% Perc**: 33,964.1 -2,035.9 1,167.0 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **65% Perc**: 35,221.1 -779.0 1,167.0 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **70% Perc**: 36,597.9 597.9 1,167.0 1,172.5 1,197.3 1,223.1 729.1 729.1 729.3 729.2 729.3 20,238.3
- **75% Perc**: 38,056.4 2,066.4 1,799.7 2,376.6 3,236.1 3,304.9 3,375.0 1,155.5 1,155.5 1,155.4 1,155.5 1,155.5 55,796.2
- **80% Perc**: 39,731.8 3,731.8 1,903.6 2,485.4 3,379.6 3,446.3 3,520.7 1,192.9 1,193.0 1,193.0 1,193.0 1,193.0 58,204.7
- **85% Perc**: 41,363.3 5,368.3 2,020.3 2,633.9 3,540.7 3,612.1 3,686.4 1,235.7 1,235.7 1,235.7 1,235.7 1,235.7 60,940.9
- **90% Perc**: 43,154.5 7,415.4 2,159.9 2,795.8 3,733.0 3,805.2 3,881.6 1,282.6 1,282.6 1,282.6 1,282.6 1,282.6 64,186.7
- **95% Perc**: 46,181.5 10,181.5 2,340.8 3,005.1 3,982.1 4,059.3 4,137.0 1,352.1 1,352.1 1,352.1 1,352.4 1,352.4 68,416.4

### Financial Ratios

- **Skewness**: -0.3 -0.3 -0.0 -0.2 -0.3 -0.3 0.0 0.0 0.0 0.0 0.0 0.0 -0.3
- **Kurtosis**: 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2.4
- **Errors**: - - - - - - - - - - - - -
10.6 Appendix F

Calculations for determining the value of synergies post premium paid, as of Bruner et al. (1998).

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>Chrysler share price</td>
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<tr>
<td>Price paid (million dollars)</td>
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<tr>
<td>Number of shares (million)</td>
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</tr>
<tr>
<td>Price paid per chrysler share</td>
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<td>Premium per share</td>
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<td>Premium per share, %</td>
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<td>Synergies per share, before premium paid</td>
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<td>Synergies per share, post premium paid</td>
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