

When do Firms Invest in Corporate Social Responsibility? A Real Option Framework

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Abstract In this paper, the process for firms to decide whether or not to invest in corporate social responsibility is treated from a real option perspective. We extend the Husted (J Bus Ethics 60:175–183, 2005) framework with an important extra parameter that allows us to understand the timing of CSR investment and explain why some companies drag their feet over CSR investments. Our model explicitly allows for the impact of the opportunity cost of delaying the CSR investment decision, providing firms with tools to determine the optimal moment of exercising the CSR investment option. We illustrate our timing model through a case study and analyze governmental support strategies for CSR from a real options perspective.

Keywords Real options · CSR · Stakeholder management · Reputational risk · Optimal timing

JEL Classification D81 · G13 · G31 · M14 · K42

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Introduction

The question why firms need to invest in corporate social responsibility (CSR) is subject to an ongoing debate over the last 20 years (McWilliams and Siegel 2001). Researchers assumed that firms would be more willing to invest in CSR if there exists a clear business case to justify committing resources to CSR (Epstein and Roy 2003). The literature therefore examined the link between good business practices and firm financial performance (McWilliams and Siegel 2000; Roberts and Dowling 2002). A meta-analysis of 52 empirical studies by Orlitzky et al. (2003) finds a positive association between corporate social performance (CSP) and corporate financial performance (CFP). Similar findings are reported in other studies. Van Beurden and Goessling (2008) find that 68 % of the included studies show a significant positive result between CSP and CFP, 26 % shows no relationship and 6 % a negative relationship. Margolis and Walsh (2003, p. 277) examine 127 empirical studies between 1972 and 2002 and “the findings suggests there is a positive association between a company’s social performance and its financial performance.” Corporate irresponsible behavior has also been found to lead to negative corporate financial performance (Engelen and van Essen 2011).

Despite this macro-level evidence, firm behavior at the micro level seems at odds with the evidence as individual firms find it difficult to justify CSR investments on economic grounds: “A careful analysis of the cost and benefits of CSR projects in terms of cash flows, using traditional techniques of valuation, often leads to the decision to forego such investments” (Husted 2005, p. 176). One of the reasons for this rejection is that the net present value (NPV) or cost-benefit approach ignores the strategic value of CSR investments. Hart and Milstein (2003) call for a

real option approach to value such investments. Husted (2005) therefore analyzed CSR within a real option framework in order to better capture the firm-level CSR decision-making process. His framework uses a standard option model without accounting for any parameter for the opportunity cost in postponing the investment decision. However, this is an important parameter in explaining companies' investment behavior. Real option models predict that companies will defer the investment decision to commit resources until more information is available or "until after the nature of an uncertain environment has revealed itself" (Husted 2005, p. 177).

As long as companies have some leeway in postponing the investment decision in the absence of any opportunity cost of waiting, companies will always delay investment. This is exactly the type of investment behavior one observes in reality, for instance, with respect to investments in carbon capture and storage (CCS): firms do not commit resources to CCS despite the societal interest for preventing global warming (Sanders et al. 2013). A similar thing might occur with respect to investments in CSR. However, the question *when* an individual company should invest in CSR is largely underdeveloped. The extensive literature on CSR teaches us how the economic success of companies depends increasingly on the actions and reactions of stakeholders (Freeman 1984; Burke and Logsdon 1996; Lindgreen et al. 2012). CSR investment is one way to approach stakeholders in order to control CSR related risks and opportunities (Bhattacharya et al. 2010). However, all this leaves open the question of when to invest in CSR. In this article we therefore address the question of the optimal timing of a CSR investment by using an extended model of the Husted (2005) framework.

We illustrate our real option framework by a case study of IHC Caland, a Dutch industrial company confronted with the question whether or not to invest in CSR by foregoing a large project in Burma, a country heavily criticized for systematic human rights violations. This case is particularly interesting as human rights figure prominently in the CSR debate (Blanton and Blanton 2006). In the case study we put ourselves at the CEO's viewpoint and follow the company's decisions at three key moments over the six year period between 1998 and 2003. At each key moment we examine the magnitude of the value drivers of the real option model and their impact on the company's decision. The model allows us to determine the optimal timing for the CSR investment and to explain the shift in the company's investment policy. Finally, we use the real option framework to classify public policies around CSR in terms of effectiveness.

We thus contribute to the literature in three ways. First, we extend the Husted (2005) model by incorporating an important option value driver, being the opportunity cost of

delaying the CSR investment decision. Second, we present a conceptual framework to better understand the *timing* of companies' CSR decisions by modelling the micro-level CSR investment decision. Our model linking stakeholder theory to micro-level investment modelling gives important insights to both companies as well as different stakeholders in understanding the dynamics of CSR investment behavior. Third, we discuss how governments can induce companies to engage in CSR investments by leveraging one of more value drivers of the real option framework.

The remainder of this paper is structured as follows. The first section introduces the real option framework and contrasts it to the traditional NPV-type of investment decision criteria. We indicate how a real option approach is better in explaining waiting behavior. We illustrate this in the subsequent section through the case of IHC Caland. In the following section we look at public policies around CSR and judge their effectiveness from a real option perspective. The last section concludes.

The Real Option Approach to CSR Investments

The Concept of Real Options

The inherent limitations of firms allocating resources through a NPV framework are well-documented. Such approach assumes a now-or-never decision and presupposes that the decision maker follows a rigid path once the investment decision is taken (Feinstein and Lander 2002). In reality, in a volatile business environment with uncertainty and change, projects will not materialize in the same condition as the decision maker had initially in mind (Cassimon et al. 2004). During the project's lifetime new information might arrive or sources of uncertainty might be resolved, making it valuable to adjust the project. This gave rise to a new class of models usually referred to as 'real options' models (Trigeorgis 2000).

Real option analysis teaches us that every investment project can be seen as exercising an option. In general, an option can be defined as the right, but not the obligation, to buy (call-option) or sell (put-option) the underlying asset at an agreed price (strike price or exercise price) during a specific period (as in the case of American options) or at a predetermined expiration date (as in the case of European options). Real option analysis allow companies to put a value on managerial flexibility and strategic dimensions of investment projects, both of which are ignored by the NPV model.

The real option approach is therefore valuable in an investment environment characterized by the simultaneous existence of uncertainty, irreversibility of investment and some freedom on the timing of the investment. In this way,

a more dynamic framework to evaluate investment projects has emerged. Real option models have already been applied in a variety of business contexts such as natural resource investments (Paddock et al. 1988), consumer electronics (Lint and Pennings 2001), pharmaceutical R&D (Cassimon et al. 2011a), and mobile payment innovations (Cassimon et al. 2011b). Besides the obvious business applications, real option theory can also be used in contexts such as global warming and sustainable energy solutions (Sanders et al. 2013), criminal actions (Engelen 2004) and even the decision to invade a country (Cassimon et al. 2013). In this article, the real option model will be applied to the decision whether or not to invest in CSR.

CSR as a Real Option

It is now well established in the management literature that CSR is a key area of strategic concern and can be integrated into the strategic activities of business organizations (Burke and Logsdon 1996; Porter and Kramer 2002; Sirsly and Lamertz 2008; Wood 1991). For instance, Moura-Leite et al. (2014, p. 63) find that “nonparticipation in controversial business [...] generate competitive advantage and are instrumental for a firm’s market performance.” Hillman and Keim (2001, p. 125) make a case that “building better relations with primary stakeholders like employees, customers, suppliers, and communities could lead to increased shareholder wealth by helping firms develop intangible, valuable assets which can be sources of competitive advantage.” Hart and Prahalad (2002) stress the importance of bottom-of-pyramid investments as key drivers in creating sustainable value. If one accepts the strategic value of “actions that appear to further some social good, beyond the interests of the firm and that which is required by law” (McWilliams and Siegel 2001, p. 117), the crucial insight of real option analysis is that the option concept can also be applied to CSR investments.

Husted (2005) defines CSR investment as exercising a call option on the benefits of CSR (the underlying asset achieved upon exercise), by paying a particular investment cost of CSR (the exercise price of the real option). His model closely mirrors a CSR option to a classical financial call option on a non-dividend paying stock. As such, the five basic determinants of the value of a classical stock option can be easily translated in similar parameters in a real option terminology, applied to CSR (see Table 1). The *stock price* is translated into the present value of the expected benefits of the CSR project. The *exercise price* at which the underlying asset can be acquired is the investment cost of the CSR project. *Volatility* is now measured as the standard deviation of the expected return on the CSR project. *Time to maturity* is the actual lifetime of the real option or the window of opportunity. Finally, also the *risk-*

free interest rate matters, with the same interpretation in both cases.

We join Husted (2005) in his conceptualization of the benefit of investing in CSR as the long-term effect of increasing or maintaining the support of the company’s main stakeholders:

“CSR investments create the option, but not the obligation, for the firm to call upon stakeholders for resources it needs”. (Husted 2005, p. 178)

This conceptualization aligns with the view that “CSR is intimately tied to a firm’s relationship with its stakeholders [...] whose demands and expectations must be met by firm performance” (Sirsly and Lamertz 2008, p. 348). Firms thus need to engage in “extensive interaction and dialogue with external stakeholders, regarding both current offerings (product stewardship) as well as how they might develop economically sound solutions to social and environmental problems for the future (sustainability vision)” (Hart and Milstein 2003, p. 64). The stakeholder perspective of CSR assessing the extent to which companies meet the demands of multiple stakeholders is widely recognized in the literature (Berman et al. 1999; Heugens et al. 2002; Randel et al. 2009; Waddock et al. 2002; Wood 1991). Clarkson (1995, p. 107) classifies stakeholders into primary and secondary, where the latter are “those who influence or affect, or are influenced or affected by, the corporation, but they are not engaged in transactions with the corporation and are not essential for its survival.” The continued support of stakeholders without whose support the firm cannot survive is thus crucial.

Stakeholders will indicate how unacceptable they assess certain actions and might even withdraw their support from the firm (Mitchell et al. 1997; Randel et al. 2009). The influence of stakeholders on firm’s actions depends on their power and the legitimacy of their urgent claim (Mitchell et al. 1997). “Dependent” stakeholders with legitimate urgent claims, but who are not powerful will not threaten the firm convincingly (Randel et al. 2009) because “these stakeholders depend upon others (other stakeholders or the firm’s managers) for the power necessary to carry out their will” (Mitchell et al. 1997). A “definitive” stakeholder is both powerful and legitimate achieving high influence levels over the firm. Firms that engage in trust-based, cooperative ties with their stakeholders will have a competitive advantage over firms that do not (Heugens et al. 2002; Jones 1995). This stakeholder approach also enables CSR strategies to be fully embedded in the firm’s corporate governance strategies and systems (Mason and Simmons 2014).

As visibility to stakeholders is an important characteristic of a strategic CSR initiative, “a firm whose stakeholders attribute a very high reputation for CSR risks a

Table 1 Option value drivers, direction of impact and notation

Symbol	Impact on option value (C)	Financial options definition	Real options analogy, applied to CSR
V	+	Underlying asset price	Present value of expected benefits of CSR
I	-	Strike price	Investment cost of CSR
σ	+	Volatility of underlying asset return	Volatility of return of CSR benefits
$T-t$	+	Time to maturity	Window of opportunity
R	+	Risk free rate	Risk free rate
δ	-	Dividend yield	Opportunity cost

major backlash should there be any breach of CSR” (Sirsly and Lamertz 2008, p. 352), this implies that one could easily rephrase the conceptualization of CSR from the perspective of the literature on firm reputation. Stated from this perspective, CSR can be seen as a way of dealing ex ante with downside reputation risk, but it can also be viewed as a way of enhancing reputation (reputation building) (Fombrun et al. 2000; Fombrun and Shanley 1990). Hart and Milstein (2003, p. 61) thus integrate “the voice of the stakeholder into business processes” to enhance firm reputation and legitimacy in a sustainable value framework.

In the real option model the stakeholder support is measured through its impact on the value of the company V . At some point, refraining from investing in CSR can push major stakeholders to disengage from the company, with negative and potentially devastating effects on company value and/or even survival. As such, determining the value of investing in CSR for this case needs to focus on the stance of the firm’s major stakeholders vis-à-vis this decision (Berman et al. 1999). In general, we can identify at least four major types of stakeholders, namely its clients, its shareholders and other finance-providers, its employees (indirectly influenced by their labor unions) and the government as public interest regulator. Indirectly, other parties, such as NGOs and other types of lobbyists, can play a role by (trying to) influence these direct stakeholders. Hart and Sharma (2004) propose a richer conceptualization of stakeholders by including groups at the periphery of a firm’s established stakeholder network. They define such “fringe” stakeholders as “the poor, weak, isolated, non-legitimate, disinterested, and even non-human” that are typically disconnected from or invisible to the firm, but who “may hold knowledge and perspectives that are key both to anticipating potential future sources of problems and to identifying innovative opportunities” (Hart and Sharma 2004, p. 8 and 10). “Identifying and managing the impact key stakeholders have on the company can reduce costs by mitigating the likelihood of negative regulatory, legislative, or fiscal action” (Moura-Leite et al. 2014). We therefore analyze the influence of different stakeholders in

our case study and link it to the real option modelling framework used to take CSR investment decisions.

In the following, we will largely use the conceptualization of CSR as options on stakeholder support to model CSR investment decisions. However, we include one extension to the Husted (2005) framework that will prove to be crucial in making the CSR framework more realistic, and more accurate in explaining optimal decision behavior of firms regarding CSR investment. As mentioned before, Husted (implicitly) mirrors CSR options as options on *non-dividend* paying stocks. In fact, this means that nothing is lost while holding the option alive and not (yet) exercising it. Put differently, there is no ‘opportunity cost’ in postponing the exercise of the option (Cassimon et al. 2007).¹ This may prove to be incorrect. As such, we argue that the framework has to be extended by comparing this particular CSR option to an option on a *dividend paying* stock. As long as the holder has not executed its financial option, he is not entitled to receive the dividend payments, which are only attached to holding the underlying stock. As such, the dividend yield acts as a kind of opportunity cost of still holding the option, and not having executed. In real option contexts similar opportunity costs also arise. While waiting, firms are often exposed to opportunity costs, for instance while postponing the launch of a new product or service, they might lose market share or they might lose a first-mover advantage. The opportunity costs become clear when we take a close look at the benefits of a CSR investment: CSR investments create the possibility for the firm to call upon stakeholders’ support. Delaying to make the CSR investment therefore exposes the firm to a (gradual) loss of support from its key stakeholders. Losing first-mover advantages of CSR investment can be an important opportunity cost as “some specific outcomes of achieving first-mover advantage include being able to establish the firm as the model or benchmark against which all others are judged, setting the industry standards,

¹ Consequently, as clearly established in financial option theory, holders will never execute the option before the end of the lifetime of the option.

influencing the direction of environmental regulations, and reinforcing the firm’s reputation to embed legitimacy in the eyes of its stakeholders” (Sirsly and Lamertz 2008, p. 360). Accounting for opportunity costs in a real option model of CSR investments is therefore a necessity to capture the full dynamics of the CSR decision process. As such, we extend the five value driver real option model to a six value driver model, as in dividend paying stock option models (see Table 1), by explicitly adding the opportunity cost variable δ .

The impact of the different parameters of real options is analogous to financial options. For instance, the present value of the expected benefits as well as the volatility have a positive impact on the option value, while the investment cost or the opportunity cost have a negative impact. Table 1 gives the expected impact for each value driver on the option value. Appendix 1 provides a more technical presentation of the conventional Black–Scholes formula and its components.

The Optimal Timing of an Investment in CSR

The basic consequence of viewing the CSR decision as exercising an investment option can be illustrated by contrasting it to the conventional NPV-rule. The direct pay-off from immediate investment is given by $(V - I)$, where V is the present value of the benefits of the CSR project and I the investment cost. When this pay-off is positive, conventional NPV calculation tells us that it is worthwhile to invest. However, another alternative for the firm is to postpone its decision for some time. Delaying the investment has the advantage to gain more information with respect to the uncertain environment and to avoid being stuck in a loss-making, irreversible project. Waiting has value because the CSR project return is uncertain: while V is the most likely value that the firm expects based on the current information set, the actual value might be higher or lower than this mean. A higher uncertainty will lead to a higher real option value (see above). A firm will postpone the investment decision on a CSR project when the value of waiting, as captured by the real option value C , exceeds the value of investing immediately $(V - I)$:

$$\begin{cases} C > V - I \rightarrow \text{postpone} \\ C < V - I \rightarrow \text{invest now} \end{cases} \quad (1)$$

Rearranging Eq. (1) gives further insight into what triggers immediate investment. Equation (2) shows that the project should not only have a positive present value, but also that this value should exceed the value of waiting:

$$V > I + C \quad (2)$$

This follows from the real option logic. Once the investment is made, the optional nature is gone and the firm loses its flexibility. The value of the option today (C) can

be considered as an opportunity cost of investing, and hence must be added to the investment cost (I).

Another way of indicating the same criterion is stating that the value of the project (V) must exceed the investment cost (I) by at least the value of the option (C) in order to decide to invest now. This minimum-acceptable project value is generally called the “threshold value” of investment, in the following denoted as V^* .

The basic insight is that the firm should wait until the conventional NPV is “very large” before committing resources to CSR. A real option model can put an exact value to this threshold value. As such, the CSR investment decision to take is not *whether or not* to invest (as indicated by the conventional NPV-rule), but rather *when* to invest. Put differently, real option logic allows the firm to determine the optimal moment of exercising the CSR investment option. This intuitive reasoning is graphically represented in Fig. 1. This figure illustrates that the most important consequence resulting from the real option model is that uncertainty (in combination with irreversibility) introduces a difference between the minimum-acceptable value of the project in order to invest according to the NPV rule and the real option logic. While the NPV rule would suggest investing in CSR from point (a) onwards, where NPV becomes positive, the real option approach, driven by a correct understanding of uncertainty, would only invest when the NPV exceeds the value of waiting (C), being only from point (b) onwards. In other words, *waiting behavior* occurs as the optimal decision.

The figure also enables us to highlight the crucial importance of the volatility parameter: the greater the level of uncertainty, the more the option value curve shifts to the right. This implies that also point (b) moves to the right

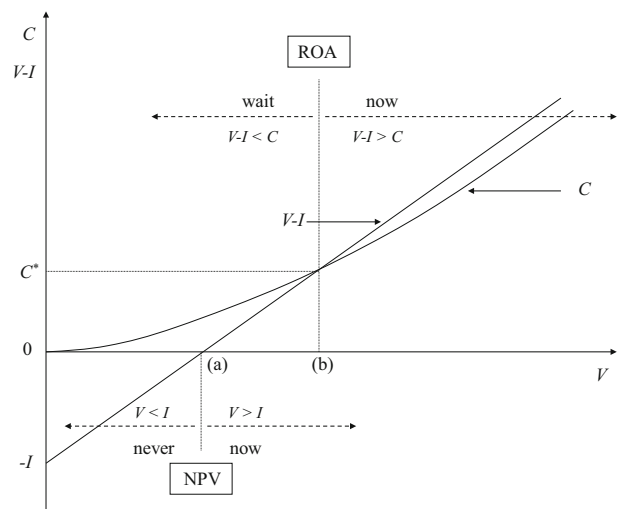


Fig. 1 Real option analysis (ROA) versus the net present value rule (NPV)

as the higher uncertainty, the more the value of the investment opportunity V must exceed its cost I before investment in CSR is indeed taking place. This is very relevant to explain the hesitant nature of investment in CSR. As the return on this type of investment is perceived highly uncertain by many CEOs, firms prefer “postponing” behavior, waiting for new information to become available on the returns of the CSR investment option and/or the behavior of other firms in the sector.

As explained in the previous section, we add an important parameter to the standard real option model. While waiting, firms can be exposed to opportunity costs, driving the option value lower than an option model without accounting for this parameter. In the model this is explicitly captured by the opportunity cost variable δ . The figure also allows to highlight the effect of the opportunity cost on the optimal decision of the investor in CSR: the larger the value of δ , the lower the option value C , so the more the option curve shifts to the left, and the *sooner* the firm will invest in CSR. The figure also clearly shows the difference between a real option model with and without opportunity costs included. Without opportunity costs included the curve C will converge towards the line $(V - I)$, but will not cross it, while the curve C will cross the line $(V - I)$ at some point when accounting for opportunity costs. This is the difference between permanent postponement and the possibility for (early) exercise of the CSR option.

A Case Study: IHC Caland When to Leave Burma?

We illustrate the dynamics of the real option approach and the impact of different value drivers on CSR decisions by analyzing a case study of *IHC Caland* on investing in Burma (now known as Myanmar). In analyzing the IHC case study from a real option perspective, we draw heavily on the facts presented in De Bakker and den Hond (2011).² As a full description of the events is outside the confines of this article, we refer the reader to this reference. At the time of the unfolding events between 1998 and 2003 IHC Caland (now known as *SBM Offshore*) faced a decision to (dis)invest in a large project in Burma. At that time a military regime was installed in the country, which was heavily criticized for systematic human rights violations. IHC Caland was a mid-cap Dutch industrial company with main activities in offshore oil and gas operations and dredging and shipbuilding divisions. At the end of 2003 the company realized a yearly turnover of about 1,850 million USD, a net profit of about 65 million USD, and gave work to about 4,100 employees across 29 countries.

² As such we do not put this reference constantly in the body of the text to improve the readability of this section.

In the case study we put ourselves at the CEO’s viewpoint and follow the company’s decisions at three key moments over the 6 year period between 1998 and 2003. At each key moment we examine the magnitude of the six real option value drivers and their joint impact on the company’s decision. We analyze (a) whether or not it is valuable for the company to engage in a CSR investment and (b) when the time is right to do so. The three key moments we analyze are (i) the initial position of entering into the contract (July 1998), (ii) the moment halfway our period of investigation when the company enters into a second contract and announces a code of conduct (May 2000) and (iii) the final moment when the company announced not to accept new projects in Burma and to address the human rights situation in the country (Summer of 2003). For each moment we first briefly describe the company’s situation, before moving to a discussion of the different value drivers.

Moment 1—The Contract

In July 1998 IHC Caland distributed a press release to announce its acquisition of a large project for the construction, lease and maintenance of a floating storage and off-loading system for a gas field in the territorial waters of Burma. The deal accounted for “several hundred million euros” and “was intended to run for 15 years” (De Bakker and den Hond 2011, p. 84). At the announcement date of the contract the project sparked an enormous wave of protest from several NGOs such as Amnesty International, Dutch Burma Center, Oxfam Netherlands and Friends of the Earth. The protest was mainly inspired by the bad human rights track record of the country’s military regime and to a minor extent by environmental concerns. The deal also caused (Dutch) trade unions and politicians to take a stance in this controversy. There was a loud call to cancel the contract and to withdraw from investing in Burma. The company was taken aback by the protest and communicated not to understand what the commotion was about. According to its CEO: “*We’re not doing anything illegal. Neither the Dutch government nor the Lower House has forbidden investment in Myanmar. So why shouldn’t we do it?*” (Financieele Dagblad 1998a). The company did not see any reason to cancel the contract and to withdraw from the investment project despite the fact that IHC Caland’s participation in controversial business in Burma appeared to be considered undesirable by a segment of society (Moura-Leite et al. 2014).

This decision can be adequately framed within a CSR real option context, and can be explained from the perspective of our real option framework, by applying the six value drivers discussed in the previous section. Applied to this concrete case, investing in CSR would translate in the

company deciding not to sign this contract in the first place, or deciding to cancel the contract in immediate response to the negative reactions. The fact that the company was not legally forbidden to do business with Burma at the time of engaging into the contract, and could always decide to cancel it later, reveals the real option nature of it. This makes the decision whether to engage in this CSR investment not a ‘now or never’ (NPV) decision, but rather a situation in which the company can freely choose (‘has the option’) to engage in this CSR investment, now or somewhere in the near future. It will base its decision on the subjective interpretation of the trade-off between investing in CSR now versus waiting to invest in CSR at a later moment, as explained in the previous section. Put differently, this decision depends on the comparison between the NPV and the value of waiting (captured by the option value C), with investment in CSR taking place when the option value is lower than the NPV.

The trade-off becomes clear when discussing the values of each of the parameters of the real option model. Let us start with determining the cost of investing in CSR (denoted in our model as I). In the IHC Caland case this is the cost of foregoing on the contract, equal to “several hundred million euros”, which would have had a clear, immediate and considerable negative impact not only on the firm’s net operating profits, but also on employment, and share price. In case the company would have decided to cancel the contract in response to the negative commotion, the investment cost would have further increased due to contractually-agreed penalties in case of a breach of contract, as well as a loss of short-term reputation of the firm vis-à-vis its most important clients in this business, being offshore gas and oil companies such as Premier Oil, Shell and Exxon.

This investment cost has to be compared with the benefit of the investment (denoted with symbol V). As argued in the previous section, the benefit of investing in CSR can best be defined as the long-term effect of increasing or maintaining the support of the company’s main stakeholders. In monetary terms this support is measured through its impact on the value of the company V . At some point, refraining from investing in CSR can push major stakeholders to disengage from the company, with negative and potentially devastating effects on company value and/or even survival. As such, determining the value of investing in CSR for this case needs to focus on the stance of the firm’s major stakeholders vis-à-vis this deal. One can identify four primary stakeholders of IHC Caland: its clients (offshore gas and oil companies), its shareholders and other finance-providers (being mainly Dutch and US institutional investors as well as banks), its employees (indirectly influenced by their labor unions) and the government as public interest regulator.

From this perspective, it was clear that the CEO did not see any reason of fearing for a negative effect on long-term stakeholder support. In fact, he was quoted saying exactly that: “*I didn’t hear a word of concern from a single employee, shareholder or supervisor*” (Parool 1998). He proved right in this statement, because despite the negative commotion in the public opinion, largely coming from activist NGOs and some politicians, at that time no major direct stakeholder was giving concrete signs (for instance, by selling its shares) that this deal would hamper the long-term overall reputation of the company. In the terminology of Mitchell et al. (1997) there was an urgent claim from a dependent stakeholder, but the lack of power did not threaten the firm, while the firm enjoyed continued support from definitive stakeholders. It is also obvious that the firm had no focus on any fringe stakeholders at the periphery of their stakeholder network or at the bottom of the economic pyramid (Hart and Sharma 2004). Clearly, the CEO did not “allow voices from beyond the core of their stakeholder network” (Hart and Sharma 2004, p. 13). As such, in the CEO’s eye, the likely benefit V of an immediate CSR investment could be considered close to zero. Taking into account the considerable investment cost I , the NPV of investing in CSR was negative; or in option terminology, the option is said to be ‘out-of-the-money’.

Note that, unlike for most other companies, the public at large is not a direct stakeholder here, as the clients of the company are not mass consumers, but other companies (business-to-business segment). This differentiates this case from the position of mass-consumer oriented firms such as *Heineken*, *Interbrew*, and *PepsiCo* that decided to withdraw from the country already in 1996 and 1997 for fears of negative effects on consumer demand for their products in their home markets. As a matter of fact, IHC Caland’s CEO explicitly referred to this stating that “*Like Heineken, then matters would be different. But we work business-to-business. In our network it’s just not an issue*” (Financieele Dagblad 1998b). While consumers can be a powerful primary stakeholder influencing firm behavior on CSR issues (Brown and Dacin 1997), IHC Caland lacked the pressure from this group not to engage in controversial business (Moura-Leite et al. 2014).

Two important additional value-drivers in our real option framework, being the uncertainty (σ) and the opportunity cost (δ) parameters, reinforce our conclusions made so far. As mentioned in the previous section, the value of CSR is best seen as following a particular probability distribution, with V denoting the most likely ‘expected’ or mean value, and the parameter σ indicating the level of dispersion around that mean. In this case, it is clear that the level of ‘uncertainty’ surrounding the expected benefit of the effect of CSR on long-term company value (V) was very high. At that moment the ex post

realized impact on V could be both positive and negative, with the most likely scenario being an impact that is close to zero. Confronted with a trade-off between a certain and considerable cost and a negligible, highly uncertain benefit, it is evident that the CEO decided not to invest in CSR at this moment.

Moreover, the opportunity cost of waiting during the lifetime of the option (δ), defined as the immediate negative effect on V in the absence of a CSR investment, was considered negligible as well. As already highlighted before, there was no sign indicating that, in the short-term, a major negative effect on the reputation of the company would occur as a result of postponing the CSR investment. Both a high uncertainty σ and low opportunity cost δ have a positive effect on the option value C to invest in CSR. This makes the option definitely higher than the NPV, which was negative anyhow. As such, the value of waiting (captured by the option value C) is higher than the value of investing now (NPV), so it is definitely optimal to postpone the CSR investment, and engage in the contract. Translating the decision framework of moment 1 of the case into our real option framework would result in situation 1 in Fig. 2.

Moment 2—The Code of Conduct

Two years later IHC Caland was again in the center of the storm. It became known that the company signed a new, albeit small, contract with Burma for the delivery of a dredging ship. Despite the smallness of this deal it reignited the fire of the protesters. Again the company did not see any problem in accepting this contract: *“If we would again find ourselves in such a situation, we would again accept the order. We work in many countries that infringe human rights. We do not think that we should act more circumspect when the [Dutch] government does not forbid investment in these countries”* (Financieele Dagblad 1999). However, the company’s stance was changing slightly as they were developing a Code of Conduct to guide investment decisions. In the meantime it became known that one Dutch bank sold its shares in IHC Caland and withdrew its activities from Burma. Pension funds increased the pressure on the company as well by asking companies to carefully weigh risks of investing in human rights infringing countries. One pension fund even sold its stake in the company. IHC Caland presented its Code of Conduct at the General Meeting of Shareholders in May 2000.

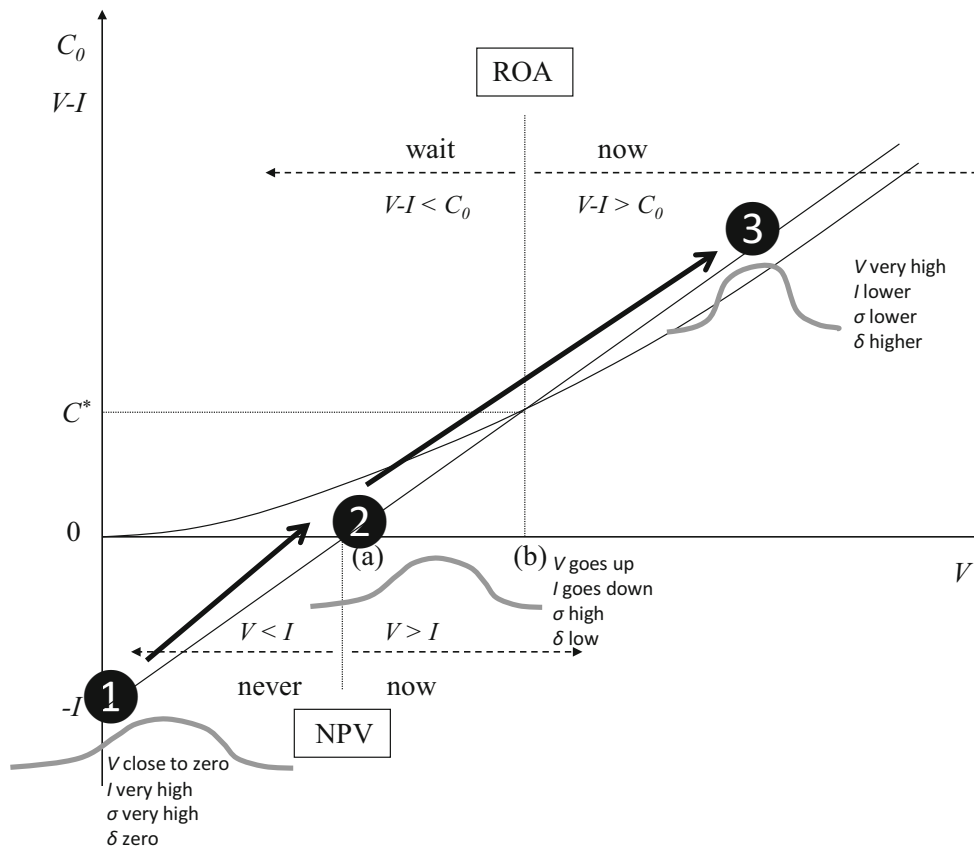


Fig. 2 Application of the IHC Caland case to a real option CSR framework

However, the company did not yet alter its investment decision with respect to Burma.

Again, this second moment, and the ultimate decision not to forgo the contract (in our terms: not to invest in CSR) can be adequately explained within our framework, by describing the relative values of the main drivers, and—when relevant—the changes relative to the first moment. First of all, relative to the first decision, the investment cost of CSR, as foregone immediate revenues from selling the ship (potentially increased by foregoing some of the not-yet realized benefits of the first deal) still mean a real, certain cost, but definitely much smaller than in the first contract. On the other hand, it becomes clear that the long-term benefit V of investing in CSR is increasing, as some (small) signs of stakeholder support erosion are emerging: isolated cases of a few shareholders selling their stake and one bank deciding to stop financing projects in Burma were reported. Indirect pressure, from activists on labor unions and on pension funds and other institutional investors, was clearly mounting. Lacking the power to directly influence the firms, activists are indeed pressing on powerful stakeholders “to carry out their will” (Mitchell et al. 1997). Although the management of IHC Caland, rightly, re-stated that “there were no clear international rules” and that that there was no direct danger that the Dutch government would go as far as to forbid all operations with Burma, regulatory efforts were concentrating on introducing (internationally-agreed) codes of conduct for multinational companies. Internally, as a reaction to public protest, the CEO acknowledged that the board of IHC Caland had never spent as much time discussing any other project as it did this one (De Bakker and den Hond 2011, p. 89). As such, compared to the first moment, the cost-benefit (NPV) trade-off definitely improved: the mean V become positive resulting in a close to zero, or even slightly positive NPV.

The fact that the NPV increased did not result in a decision to go ahead with CSR and forgo the deal. This follows again from the real option logic. As in the first moment, the long-term reputational impact is still highly uncertain (i.e. σ remains high), while the opportunity cost of investing now (δ), in terms of a major loss of support of different major stakeholders in the short-run, is still rather low. As such, while confronted with the option to wait, the value of waiting (expressed by the option value C), is still higher than the value of going ahead with CSR now (the NPV value). This is depicted in Fig. 2 as situation two. Although one can debate on the exact value and location of moment two on Fig. 2, it is merely meant as an illustration where moment two is situated relatively to the other moments.

What is indeed interesting is that the management of IHC Caland tried to buy some extra time and responded to mounting public as well as internal pressure by pretending

to invest in CSR, through statements that it was working on an internal Code of Conduct. However, it was announced repeatedly that the policy expressed in this Code of Conduct would not go as far as preventing business in countries that infringe human rights, and that the decision would not be altered, unless the government would forbid investment in these countries. As such, implementing this code could not be considered a deep investment in CSR. Not surprisingly, when the Code of Conduct was finally officially presented at a shareholders’ meeting in May 2000, it was perceived by many as pure window dressing (De Bakker and den Hond 2011, p. 90).

Moment 3—The Change of Investment Behavior

The protest against IHC Caland continued over the next 2 years and the pressure on the company continued to increase. Several other companies announced their departure from Burma, including companies such as Premier Oil, one of the direct clients of IHC Caland. NGOs called banks to stop extending loans to IHC Caland. In 2003 five important Dutch banks responded to this call by announcing not to finance any Burmese projects anymore. The company obviously felt the tremendous pressure of this decision by losing important support from its debt holders, just as it lost several equity holders earlier on. At that moment the company changed its position. The CEO announced not to accept any new orders in Burma. The company’s actions confirmed its words and it renounced a six-million euro Burmese contract of three dredging ships over the next weeks. The company also announced to address human rights issues in Burma by entering in a direct discussion with the Burmese ambassador. What has changed in the dynamics of the real option model for the company to alter its investment decision and to take up CSR at this moment in time, while it did not consider it at earlier moments?

Determining again the relative values for the real option parameters provides a clear answer to this question. Similar to moment two, the investment cost of CSR at this moment, in terms of foregone immediate additional revenue, was real but limited to the six-million euro new deal.³ In fact, IHC Caland tried to reduce the CSR investment cost by trying to limit it to future deals, while continuing to honor existing contracts. In contrast to this limited cost, mounting pressures, both direct and indirect, from ‘definitive’ stakeholders, e.g. clients, shareholders and other finance providers and the government, translated in a severe threat of withdrawal of stakeholders support for the company (Randel et al. 2009). This lost support could have a severe

³ Potentially more, substantial deals in future would be highly uncertain.

negative impact, not only on the value of the company but also on its survival ('license to operate'), in the absence of CSR investment. As such, the benefit V of investing in CSR continued to increase over time (and relative to moment two), resulting in a substantially positive NPV; in option terminology, the option is said to be 'in-the-money'. Moreover, there was much less uncertainty about the likely impact of the CSR investment on V , resulting in a probability distribution with not only a positive mean value but also less dispersion around that mean (σ becoming much lower). Finally, also the short-term opportunity cost (δ), in terms of the likelihood of a major loss of support of different key stakeholders in the very short-run, now became substantial. As a low σ and high δ both have a *negative* impact on the value of the option C , the value of waiting to invest in CSR decreased, and now became lower than the value of instant CSR investment. In Fig. 2, this trade-off is highlighted as situation three. As such, optimal real option decision making clearly explains why the company decided to switch positions now.

What is also interesting is that, as mentioned already above, IHC Caland was trying to limit its investment in CSR by limiting it to future contracts, while keeping existing contracts untouched. As a matter of fact, due to this strategy, pressure on IHC Caland from different sources continued. In the end, IHC Caland was able to hold out to additional pressure, managing indeed to limit its CSR investment to future contracts. Problems with the exact nature and enforceability of the international codes of conduct, leading to uncertainty to what extent IHC Caland's behavior ultimately did sufficiently comply with this regulation, certainly played a role in allowing IHC to resist this pressure. We will come back to this issue in the next section.

Assessing the (Cost-)Effectiveness of Public Policy Interventions to Encourage CSR

So far, we have shown that viewing investment in CSR from a (enhanced) real option framework, allows for a richer and more realistic analysis of (a larger set of) value drivers that determine the (individual) optimal investment timing and explain why and under what conditions companies postpone their CSR investments, leading to 'underinvestment' in CSR from a macro-economic perspective. In doing so, we also established the prominent role of the particular stance and actions of the key stakeholders of the firm in terms of influencing these value drivers and, ultimately, optimal CSR decisions of the firm.

In this section, we focus on one particular stakeholder, being the government in its function as regulator of the public interest, trying to incentivize (private) market participants to pursue desired behavior, through effective as

well as cost-efficient interventions. In terms of our particular framework, effectiveness relates to the intervention succeeding in switching the (optimal) decision of the firm from postponing the CSR investment to deciding to go ahead with it now; in terms of formulas (1–2), it means to make sure that the NPV ($V-I$) becomes larger than the option value C , or in other words, that V becomes larger than $I + C$. As this goal may probably be reached using different types of interventions, it is also important to try to determine which intervention is most cost-efficient from a public policy perspective.

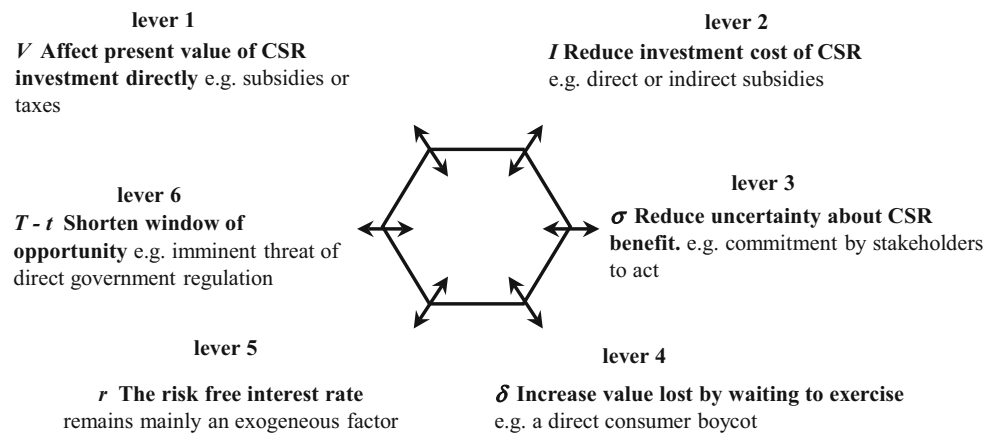
As our real option framework identifies six concrete value drivers, it is straightforward that we should assess particular policy interventions in terms of their relative impact on all of these value drivers, and on the trade-off between NPV and C , not only on their impact on NPV; moreover, it will expand the range of policy interventions, including also interventions that impact on the value of C only. Figure 3 provides an overview of the different value drivers with an example of possible CSR policies connected to this driver. We will hereafter not elaborate on each value driver separately, but group them into two subgroups: the NPV levers V and I and the non-NPV levers $T - \tau, \sigma, \delta$.⁴

Before discussing these value drivers more in detail, it is important to remark that this list of interventions does not include a direct legal intervention into the CSR issue by government, e.g. prohibiting a certain activity, and as such forcing the firm to invest in CSR now. In terms of our case study, the Dutch government could have prohibited all investments and business in Burma, effectively forcing the firm to withdraw from the country altogether, and as such engage in this particular CSR-type investment. Clearly, this is a type of intervention available to the public regulator. When this happens, translated into our option framework, it means that the option expires, and the decision criterion immediately switches back to the NPV criterion. In fact, in this case, losing the support of such a key stakeholder as the government and risking prosecution (probably accompanied by losing other stakeholder's support) may lead to endangering survival ('licence to operate'), most likely making the NPV positive, as the value V of CSR investment will most likely be high, relative to the investment cost. Not investing would in fact be equal to pursuing a criminal activity; only when the firm thinks the benefits of the crime (before, the investment cost of CSR) exceed the cost, it might still consider not to invest.⁵ In most instances

⁴ As the sixth value driver, the interest rate r , is largely exogenous, we do not consider it further here.

⁵ In fact, this might transfer the CSR investment problem into another type of real option, i.e. a criminal option. See e.g. Engelen (2004), or Cassimon, Engelen and Reyntjens (2013) for applications.

Fig. 3 The influence of public policy intervention on CSR investment behavior



however, public policy makers try to avoid such drastic interventions. Moreover, in case they do use them, it is imperative that these legal interventions are sufficiently precise and without room for interpretation, which is often not the case, hampering effectiveness.

Public Policy Interventions that Influence NPV Only

A government has many options to influence the NPV of a CSR investment directly. Subsidies and taxes related to the CSR action are two obvious candidates. While subsidies may target both at reducing the investment cost or increase the return on CSR investment (V), typically, taxes refer to the latter. Examples of this type of interventions are manifold.⁶

What is particular to interventions that target either V or I , is that they affect both NPV as well as option value C , in the same direction; translated into Fig. 1, say, a reduction in the investment cost increases both the NPV as well as C , making both curves shift upward. However, this intervention does lead to CSR investment happening sooner (a net shift of point b to the left) because the effect on the NPV is larger than that on C . Again, in order to make this intervention effective, it should make NPV becoming bigger larger than C . Here also, effectiveness has to be combined with cost-efficiency. Determining the exact level of the intervention is crucial but may prove to be very difficult: the level of the intervention should be high enough to make the firm switch (effectiveness), but over-intervention hampers cost-efficiency.

Different interventions typically have distinct cost-efficiency characteristics. Granting subsidies may lead to

substantial governmental budgetary outlays, hampering efficiency, but also taxes, although they may lead to increased revenues instead of direct budgetary cost, may have their indirect societal costs.

A distinct alternative class of interventions influencing NPV, typically through increasing V , is a restricted form of a direct legal ban, limited to market operations with the public sector only, such as in public procurement policies incorporating strict CSR criteria. Only to the extent that the public sector is an important client for a given market, this policy can be made effective.

Non-NPV Levers: Option Window, Uncertainty and Opportunity Costs

Contrary to interventions impacting only V and I , these interventions only affect the option value C , and are targeted at reducing C to a level lower than the NPV, triggering immediate CSR investment. Levers to reach this objective include reducing uncertainty, increasing the opportunity cost, and/or reducing the option window. As shown in the case study in Sect. 3, in the absence of an immediate, clear, direct and legally-binding public policy stance forcing CSR investment, there may be considerable doubt to what extent CSR investment will have a positive return (uncertainty), when and if such a clear legal enforcement will ultimately be put in place (option window), and to what extent stakeholders will impose in the short run costs on the firm when not investing in CSR (opportunity cost). As a surrogate for these more direct interventions, government policy can try to use more indirect, less intrusive interventions that try to influence firm policy by working on one or more of these three levers.

The typical ways by which public policy can try to reduce the long-term uncertainty surrounding CSR investment is trying to *stimulate self-regulation* by the private sector, in which the public sector can be associated as a

⁶ Europe went for instance through an intensive round of renewable energy subsidies which had a huge influence on the CSR investment around renewable energy (e.g. solar panels, windmills, etc.) by private companies. With the subsidy frenzy over, we witnessed an equally remarkable drop in renewable energy investments by companies and civilians alike.



partner.⁷ The typical case here is the stimulation of firm-specific or sector-specific Codes of Conduct, by which the firm or sector self-proclaim to follow certain principles implying CSR investment. Once they are in place as a credible instrument, they can also have an influence on increasing the opportunity cost of not investing in CSR (δ). As seen also in the case study however, it is very difficult to make this kind of policy effective on their own, as they are generally regarded as difficult to monitor, hard to enforce and leaving substantial room for interpretation. In order to make these initiatives effective, they may need to be accompanied by public policy interventions that affect also the option window (lever $T-t$), by *threatening to impose more direct enforcement* types of intervention.

A similar story can be told about other fora where NGOs, governments and businesses meet around a concrete, specific topic and try to induce investment in CSR. The Equator Principles and the Kimberley Process Certification Scheme are cases in point.⁸ Although there is considerable discussion about the effectiveness of both initiatives there is no doubt that they had a serious influence on CSR investments in financial services and diamond industry.

A distinct type of public intervention that aims at long-term reduction of uncertainty relates to building general awareness,⁹ either to a diverse public of stakeholders, and the public at large, or through supporting specific NGOs that focus their activities on specific CSR-linked advocacy. Once general awareness is established, it is typically targeted actions of ‘naming and shaming’ by these NGOs or public entities that are most effective in influencing (other) direct stakeholders and affecting firm decisions, by having a large effect on the opportunity cost of waiting to invest in CSR (δ).

Over the past decades governments have introduced an impressive battery of CSR policies which might or might not be effective. As indicated above, a real option perspective allows you to hypothesize which one of these policies could be effective in terms of increasing the likelihood of actual CSR investments and which will be less effective. In a follow

up paper we would like to present a more elaborate analysis of the many different policies used in the EU, here we just provide the basic intuitions on how a real option frame could steer government policies around CSR.

Conclusion

Despite the empirical evidence in the academic literature on the positive impact of investments in corporate social responsibility (CSR), firm behavior seems at odds with the evidence as individual firms find it difficult to justify CSR investments on economic grounds. Relying too much on traditional capital budgeting models is one of the reasons for this rejection as net present value approaches ignore the strategic value of CSR investments (Hart and Milstein 2003). As the strategic dimensions of CSR are now well established in the management literature (Burke and Logsdon 1996; Hillman and Keim 2001), analyzing CSR investments through a real option lens would be a first step. In his seminal contribution Husted (2005) introduced real options in order to capture the CSR decision process of the firm.

A second step would be to enrich the basic real option model to better reflect corporate decision making. Husted’s framework lacked an important variable—the opportunity cost of the investment—which we hold responsible for explaining waiting behavior among companies when it comes to investments with an unclear payoff. We show that in the absence of any opportunity cost of waiting, companies will always delay CSR investments. We therefore extend the Husted (2005) model by incorporating this important option value driver and explicitly allow for the impact of the opportunity cost of delaying the CSR investment decision. As such, the CSR investment decision to take is not whether or not to invest, but rather when to invest. Put differently, real option logic allows firm to determine the optimal moment of exercising the CSR investment option once we include the opportunity cost parameter.

We illustrate our enriched framework by analyzing the ICH Caland case. We conduct a clinical study of the Dutch industrial company confronted with the question whether or not to invest in CSR by foregoing a large project in Burma, a country heavily criticized for systematic human rights violations. The company exhibited the typical waiting behavior before committing resources to CSR investment. We believe that this type of postponing of CSR investments can be observed with respect to many CSR issues. An extended real option frame provides the economic logic for such postponing behavior. At three key moments we therefore examine the magnitude of the value drivers of the real option model and their impact on the company’s decision. The model allows us to determine the optimal timing for the CSR investment and to explain the

⁷ Sometimes labelled as *partnering*; a direct collaboration between government organizations with firms or business associations, in which public sector bodies can function as participant, convener, or facilitator (Moon et al. 2010; Fox et al. 2002).

⁸ A well-known example is *The Ethical Trading Initiative* (ETI). Set up in the UK mainly through government money from the Department for International Development, it brings together NGOs, companies and trade unions with the aim to improve working conditions in the apparel industry. Several companies reacted to ETI by increasing their CSR investments. It was clear from the start—due to the government commitment and the money invested—that ETI would not be reduced to a talking shop but stood a serious chance of increasing the monitoring around social conditions in the supply chain.

⁹ Fox et al. (2002) refer to it as *endorsement*, defined as any form of political support and affirmation of the concept of CSR and related initiatives.

shift in the company’s investment policy based on shifts in the different value drivers.

In the clinical study we analyze the influence of different stakeholders and link it to the real option modelling framework used to take CSR investment decisions. We conceptualize the benefit of investing in CSR as the long-term effect of increasing or maintaining the support of the company’s main stakeholders. The stakeholder perspective of CSR assessing the extent to which companies meet the demands of multiple stakeholders is widely recognized in the literature (Berman et al. 1999; Hart and Milstein 2003; Randel et al. 2009; Lindgreen et al. 2012). Our timing model linking stakeholder theory to micro-level investment theory gives important insights to both companies as well as different stakeholders in understanding the dynamics of CSR investment behavior.

Insight into the dynamics of the real option model is also extremely valuable for governments. In the final section we discuss how the real option perspective could guide public policy around CSR because it allows predicting which government policies ought to be effective and which not. Our timing model will guide public policy makers towards the value drivers with more leverage on inducing companies to engage in CSR investments in specific contexts and areas. In a next stage this conceptual analysis of the real option framework could be extended with a more empirical approach that tries to underpin the theoretical predictions.

Appendix 1: The Black–Scholes Formula for Call Option Valuation

The valuation models for real options are based on the financial options’ models. The most commonly used model has been developed by Black and Scholes (1973) and Merton (1973) and is commonly referred to as the Black–Scholes model. Its popularity is derived from its closed-form solution, allowing computing the value much more simple, and in addition, the model makes it easier to conduct a sensitivity analysis using partial derivatives. The Black–Scholes analysis assumes the following (Hull 2000): (1) frictionless markets, i.e. no transaction costs or taxes, nor restrictions on short sales; (2) continuous trading is possible; (3) the risk-free (short-term) interest rate is constant over the life of the option; (4) the market is arbitrage-free; (5) the time process of the underlying asset price is stochastic and exhibits a geometric Brownian motion.¹⁰ This process assumes asset prices to be log-normally

¹⁰ This can be expressed by the following equation: $dS = \mu S dt + \sigma S dz$, according to which a price change dS in a small time interval dt consists of two components; a deterministic component (μ), also called the drift, which measures the average growth rate of the asset price and a random or stochastic component

distributed and returns to be normally distributed. Obviously, any violation of some of these assumptions may result in a different option valuation model. The goal of this article is not to provide a precise estimate of the CSR option value, but to present a richer conceptual framework that provides additional insights compared to a more conventional NPV analysis. It will be left to future research which option valuation model is the most appropriate to value CSR options, whenever a more precise estimate of the option value matters. The option value C according to the Black–Scholes model can be calculated as:

$$C = V e^{-\delta(T-t)} N(d_1) - I e^{-r_c(T-t)} N(d_2), \quad \text{where} \quad (A.1)$$

$$d_1 = \frac{\ln\left(\frac{V}{I}\right) + \left(r_c - \delta + \frac{1}{2}\sigma^2\right)(T-t)}{\sigma\sqrt{T-t}} \quad (A.2)$$

$$d_2 = \frac{\ln\left(\frac{V}{I}\right) + \left(r_c - \delta - \frac{1}{2}\sigma^2\right)(T-t)}{\sigma\sqrt{T-t}} = d_1 - \sigma\sqrt{T-t}, \quad (A.3)$$

where V is the present value of the future FOCFs from CSR, I is the capital expenditure (CSR investment cost), $T-t$ is the time to expiration (in years), σ is the annualized standard deviation of the CSR project return (V), r_c is the continuous risk-free interest rate, δ is the opportunity cost, and $N(d)$ is the cumulative normal probability density function.

The effect of a change in one of the parameters on the value of the call option (the so-called Greeks), i.e. the first derivative, is calculated as follows

Sensitivity of C to	Name and symbol	Formula and sign of impact on C
Benefits of investment in CSR (V)	Delta Δ	$e^{-\delta(T-t)}N(d_1) > 0$
Investment cost of CSR (I)	Psi Ψ	$-e^{-r(T-t)}N(d_2) < 0$
Lifetime ($T-t$)	Theta Θ	$\frac{-V n(d_1) \sigma e^{-\delta(T-t)}}{2\sqrt{T-t}} - r I e^{-r(T-t)} N(d_2) + \delta V N(d_1) e^{-\delta(T-t)} > 0$
Risk-free interest rate (r)	Rho ρ	$I(T-t)e^{-r(T-t)}N(d_2) > 0$
Volatility (σ)	Vega V	$V\sqrt{T-t}N(d_1)e^{-\delta(T-t)} > 0$
Opportunity cost (δ)	Ksi \equiv	$-V(T-t)e^{-\delta(T-t)}N(d_1) < 0$

The value $N(d_1)$ is the derivative of the standard normal distribution function with respect to d_1

Footnote 10 continued (σ), also called the volatility, which measures the strength of the statistical price fluctuations.



References

- Bhattacharya, C. B., Smith, N. C., & Palazzo, G. (2010). Marketing's consequences: Stakeholder marketing and supply chain CSR issues. *Business Ethics Quarterly*, 20(4), 617–641.
- Berman, S., Wicks, A., Kotha, S., & Jones, M. (1999). Does stakeholder orientation matter? The relationship between stakeholder management models and firm financial performance. *Academy of Management Journal*, 42, 488–506.
- Black, F., & Scholes, M. (1973). The pricing of options and corporate liabilities. *Journal of Political Economy*, 81, 637–659.
- Blanton, S., & Blanton, R. (2006). Human rights and foreign direct investment. A two-stage approach. *Business and Society*, 45, 464–485.
- Brown, J., & Dacin, P. (1997). The company and the product: Corporate associations and consumer responses. *Journal of Marketing*, 61, 68–84.
- Burke, L., & Logsdon, J. (1996). How corporate social responsibility pays off. *Long Range Planning*, 29, 495–502.
- Cassimon, D., De Backer, M., Engelen, P. J., Van Wouwe, M., & Yordanov, V. (2011a). Incorporating technical risk into a compound option model to value a pharma R&D licensing opportunity. *Research Policy*, 40, 1200–1216.
- Cassimon, D., Engelen, P. J., & Reyntjens, F. (2013). Rwanda's involvement in Eastern DRC: A criminal real options approach. *Crime, Law, and Social Change*, 59, 39–62.
- Cassimon, D., Engelen, P. J., Thomassen, L., & Van Wouwe, M. (2004). Valuing new drug applications using n-fold compound options. *Research Policy*, 33, 41–51.
- Cassimon, D., Engelen, P. J., Thomassen, L., & Van Wouwe, M. (2007). Closed-form valuation of American call-options with multiple dividends using n-fold compound option models. *Finance Research Letters*, 4, 33–48.
- Cassimon, D., Engelen, P. J., & Yordanov, V. (2011b). Compound real option valuation with phase-specific volatility: A multi-phase mobile payments case study. *Technovation*, 31, 240–255.
- Clarkson, M. (1995). A stakeholder framework for analysing and evaluating corporate social performance. *Academy of Management Review*, 20, 92–117.
- Financieele Dagblad, H. (1998a). IHC Caland snapt niets van dreiging met boycot. *Het Financieele Dagblad*, 15 July.
- Financieele Dagblad, H. (1998b). Gedane zaken nemen geen keer bij IHC. *Het Financieele Dagblad*, 25 August.
- Financieele Dagblad, H. (1999). 'ABP geeft IHC nog een jaar tijd voor gedragscode.' *Het Financieele Dagblad*, 5 June.
- De Bakker, F., & den Hond, F. (2011). "Chapter 7. A Disputed Contract: IHC Caland in Burma", In W. Dubbink, L. van Liedekerke and H. van Luijk (eds.), *European business ethics casebook. The morality of corporate decision making*, Issues in Business Ethics 29, 77–98.
- Engelen, P. J. (2004). Criminal behavior: A real option approach. With an application to restricting illegal insider trading. *European Journal of Law and Economics*, 17, 329–352.
- Engelen, P. J. & van Essen, M. (2011). Reputational penalties on financial markets to induce corporate responsibility. In W. Vanderkerkhove et al. (Eds.), *Responsible investment in times of turmoil* (Issues in Business Ethics Series), (pp. 55–74). New York: Springer Publishers.
- Epstein, M., & Roy, M. (2003). Making the business case for sustainability. *Journal of Corporate Citizenship*, 9, 79–96.
- Feinstein, S., & Lander, D. (2002). A better understanding of why NPV undervalues managerial flexibility. *The Engineering Economist*, 47, 418–435.
- Fobrum, C., & Shanley, M. (1990). What's in a name? Reputation building and corporate strategy. *Academy of Management Journal*, 33, 233–258.
- Fombrun, C., Gardberg, N., & Barnett, M. L. (2000). Opportunity platforms and safety nets: Corporate citizenship and reputational risk. *Business and Society Review*, 105, 85–106.
- Fox, T. Ward, H., & Howard, B. (2002). 'Public sector roles in strengthening corporate social responsibility: A baseline study', World Bank & IEED, <http://pubs.iied.org/16017IIED.html>
- Freeman, R. (1984). *Strategic management: A stakeholder approach*. Boston: Pitman.
- Hart, S. L., & Milstein, M. B. (2003). Creating sustainable value. *Academy of Management Executive*, 17(2), 56–67.
- Hart, S. L., & Prahalad, C. K. (2002). The fortune at the bottom of the pyramid. *Strategy + Business*, 26, 54–67.
- Hart, S. L., & Sharma, S. (2004). Engaging fringe stakeholders for competitive imagination. *Academy of Management Executive*, 18(1), 7–18.
- Heugens, P., Van den Bosch, F., & van Riel, C. (2002). Stakeholder integration. Building mutually enforcing relationships. *Business and Society*, 41, 36–60.
- Hillman, A., & Keim, G. (2001). Shareholder value, stakeholder management, and social issues: What's the bottom line? *Strategic Management Journal*, 22, 125–139.
- Hull, J. C. (2000). *Options, futures and other derivatives*. Upper Saddle River, New Jersey, USA.
- Husted, B. (2005). Risk management, real options, and corporate social responsibility. *Journal of Business Ethics*, 60, 175–183.
- Jones, T. (1995). Instrumental stakeholder theory: A synthesis of ethics and economics. *Academy of Management Review*, 20, 404–437.
- Lindgreen, A., Kotler, P., Van Hamme, J., & Maon, F. (Eds.). (2012). *A stakeholder approach to corporate social responsibility: Pressures, conflicts, and reconciliation*. Aldershot: Gower.
- Lint, O., & Pennings, E. (2001). An option approach to the new product development process: A case study at Philips electronics. *R&D Management*, 31(2), 163–172.
- Mason, C., & Simmons, J. (2014). Embedding corporate social responsibility in corporate governance: A stakeholder systems approach. *Journal of Business Ethics*, 119, 77–86.
- Margolis, J. D., & Walsh, J. P. (2003). Misery loves companies: Rethinking social initiatives by business. *Administrative Science Quarterly*, 48(2), 268–305.
- McWilliams, A., & Siegel, D. (2000). Corporate social responsibility and financial performance: Correlation or misspecification? *Strategic Management Journal*, 21(5), 603–609.
- McWilliams, A., & Siegel, D. (2001). Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review*, 26, 117–127.
- Merton, R. C. (1973). Theory of rational option pricing. *The Bell Journal of Economics and Management Science*, 141–183.
- Mitchell, R., Agle, B., & Wood, D. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, 22, 853–886.
- Moon, J., Kang, N., & Gond, J.-P. (2010). Corporate social responsibility and government. In D. Coen, W. Grant, & G. Wilson (Eds.), *Oxford handbook of business and government*. Oxford: Oxford University Press.
- Moura-Leite, R., Padgett, R., & Galan, J. (2014). Stakeholder management and nonparticipation in controversial business. *Business and Society*, 53, 45–70.
- Orlitzky, M., Schmidt, F. L., & Rynes, S. L. (2003). Corporate social and financial performance: A meta-analysis. *Organization Studies*, 24(3), 403–441.

- Paddock, J., Siegel, D., & Smith, J. (1988). Option valuation of claims on real assets: The case of offshore petroleum leases. *Quarterly Journal of Economics*, 103, 479–508.
- Parool, H. (1998). 'IHC Caland ziet in Birma geen weg meer terug.' *Het Parool*, 25 August.
- Porter, M., & Kramer, M. (2002). The competitive advantage of corporate philanthropy. *Harvard Business Review*, 80, 3–15.
- Randel, A., Jaussi, K., & Standifird, S. (2009). Organizational responses to negative evaluation by external stakeholders. The role of organizational identity characteristics in organizational response formulation. *Business and Society*, 48, 438–466.
- Roberts, P., & Dowling, G. (2002). Corporate reputation and sustained superior financial performance. *Strategic Management Journal*, 23, 1077–1093.
- Sanders, M., Fuss, S., & Engelen, P. J. (2013). Mobilizing private funds for carbon capture and storage: An exploratory field study in the Netherlands. *International Journal of Greenhouse Gas Control*, 19, 595–605.
- Sirsly, C. A. T., & Lamertz, K. (2008). When does a corporate social responsibility initiative provide a first-mover advantage? *Business and Society*, 47, 343–369.
- Trigeorgis, L. (2000). Real options and financial decision-making. *Contemporary Finance Digest*, 3, 5–42.
- Van Beurden, P., & Goessling, T. (2008). The worth of values—A literature review on the relation between corporate social and financial performance. *Journal of Business Ethics*, 82, 407–424.
- Waddock, S., Bodwell, C., & Graves, S. (2002). Responsibility: The new business imperative. *Academy of Management Executive*, 16, 132–148.
- Wood, D. (1991). Corporate social performance revisited. *Academy of Management Review*, 16, 691–718.

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