

Reputation, Information and Project Termination in Capital Budgeting

JOHN DOBSON
California Polytechnic State University

ROBERT DORSEY
University of Mississippi

Abstract

The Net Present Value (NPV) rule of financial theory gives management a decisive criterion for choosing between abandonment versus continuation of capital projects. There is extensive evidence, however, that management chooses to delay the abandonment of unprofitable projects. This paper attempts to explain management's reluctance to abide by the NPV criterion. The concept of a Reputation Adjusted Net Present Value is introduced in an environment where management knows more about the true value of a project than do stakeholders. The model indicates that, in such an environment, the continuation of a negative NPV project may maximize firm value.

Introduction

The Net Present Value (NPV) rule of financial theory gives management a criterion for choosing between abandonment versus continuation of capital projects. Statman and Caldwell (S&C) [17] summarize the criterion as follows;

"sunk costs should be ignored and ... projects should be terminated when the expected present value of cash flows, given that the project is terminated today, is greater than the expected present value of cash flows given that the project is continued for at least one additional period" (p. 7).

As S&C note, however, there is ample evidence that managers do not abide by the NPV criterion. Managers continue with projects that, according to the NPV rule, should be abandoned. This apparently aberrant behavior prompts two alternative explanations. (1) Managers do

not act to maximize firm value (i.e. there is an agency problem, or perhaps managers are not value maximizers). (2) Managers are firm value maximizers, however they do not believe that the NPV criterion will maximize firm value.

S&C argue in favor of the first alternative. They invoke the concept of a "behavioral finance" in which psychological factors play an important role in determining managerial behavior. S&C note that individuals are generally reluctant to admit defeat, and thus management's "regret aversion" (p. 6) leads it to delay the termination of unprofitable projects. By not adhering to the NPV criterion, therefore, management acts in a way that is detrimental to firm value, and indeed to aggregate economic welfare. Other arguments for the first alternative have also been presented with a psychological justification in Thaler [21] (psychic accounting), Laughhunn and Payne [11] (framing), and Staw [19].² Kanodia, Bushman, and Dickhaut [8] also

argue for the first alternative by invoking agency theory. They show that managers' concern for their personal reputations induce them to delay project abandonment at the expense of firm value. In their model, therefore, managers are not firm value maximizers.

Corporate decisions are undoubtedly influenced by psychological factors and the existence of agency problems is well documented. The implications are unsettling, however, if actual capital budgeting decisions can only be explained with reference to such arguments. This paper appeals to the second argument. Managers may in fact be using an alternate rationale for maximizing the value of the firm. We propose a simple model incorporating the reputation of the firm into the net present value criterion to demonstrate that management's choice to continue a negative NPV project is consistent with an objective of firm value maximization.

We claim that over time, the firm builds a reputation for an ability and commitment to identify and complete successful investment projects. We assume in this model that management's reputation is synonymous with the reputation of the firm. This is contrary to the assumption of Kanodia, Bushman and Dickhaut [8] but we feel that it is justified because top managers are often associated with their firm long after they have left or joined other firms. Owner/managers clearly perceive the reputation of the firm to be consistent with their own reputation. Our conception of reputation builds on the pioneering work of Kreps and Wilson [10], and Milgrom and Roberts [12], in which reputation is invoked as an implicit contractual enforcement mechanism in multi-period games. More recently this concept of reputation has been applied in finance contexts by John and Nachman [7], and Diamond [5]. These theoretical papers find that in informationally asymmetric

markets firms will rationally build reputations, i.e. will refrain from opportunistic behavior, in order to minimize agency costs. Similarly, on the empirical side, Beatty and Ritter [2], and Carter and Manaster [3] find evidence that a firm's reputation is priced in financial markets. Other things being equal, a reputable firm will have a higher market value than a disreputable firm.

Managers correctly realize that the NPV criterion does not capture the reputation costs associated with a project abandonment announcement. Although these reputation costs do not appear in conventional capital budgeting analyses, they are costs that will affect firm value. They are incurred whenever the reputation of the firm declines. We do not refute the standard NPV criterion. We do suggest, however, that it is a perfect-information special case of a more general decision rule which incorporates the reputation costs associated with an abandonment announcement.

Cornell and Shapiro (C&S) [4] emphasize the importance of stakeholder claims in determining firm value. They note that stakeholders often hold claims that are implicit, "such as the promise of continuing service to customers and job security to employees" (p. 6). C&S define an implicit claim as "too nebulous and state contingent to reduce to writing at reasonable cost" (p. 6). They note that the risk associated with these claims is difficult to diversify and that their value may be entirely dependent upon the success of a single project undertaken by the firm. In addition, as Barton et al. [1] note, "Perceived failure in one product line would likely cast a shadow on other products, thus limiting the firm's ability to sell implicit claims in these related businesses" (p. 38).

A firm's reputation is reflected in the value of implicit claims it sells to stakeholders. By

building a reputation, the firm increases the value of both currently outstanding implicit claims, and claims to be sold in future periods. Any individual claimholder has no direct recourse in the event that the firm fails to honor an implicit claim. As a group, however, claimholders can 'punish' a firm that reneges by lowering the price at which they will buy implicit claims from the firm in the future. This ex-post settling-up constitutes the reputation cost and can be measured as the discounted reduction in value of all current and future implicit claims sold by the firm.

We hypothesize that a firm which has built a reputation for identifying and completing profitable projects will suffer significant reputation costs in the wake of an abandonment announcement. These reputation costs will be reflected in a lowering in value of a broad spectrum of implicit claims sold by the firm in current and future periods. In deciding whether to continue or abandon a negative NPV project, therefore, management must weigh the reputation costs associated with an abandonment announcement against the probability of deceiving stakeholders as to the worth of the project through its continuation. Clearly, such deception cannot continue indefinitely. Either the prospects for the project will improve or eventually the true worth of the project will be revealed; perhaps through cost overruns or delayed completion dates. As the model below shows, however, management may maximize firm value by at least temporarily continuing a project that, according to the NPV criterion, should be abandoned immediately.

A Capital Budgeting Model with Reputation Effects

Our model rests on the assumption of informational asymmetry between management (implicit

claim writers) and stakeholders (implicit claim purchasers). The informational asymmetry takes the form of management knowing more about the "true" value of investment projects currently underway than do stakeholders. If management believes sufficient informational asymmetry exists, it may continue with a negative NPV project in order to preserve its reputation and thus minimize the present value of reputation costs. The reputation's rate of decay will depend upon the rate at which information concerning the true value of the project is revealed.

The timing of an abandonment announcement, therefore, is not dependent solely on the underlying NPV of the project. Rather, it has to do with management's belief concerning the signalling effect that the announcement will have on firm value. Management will only announce the abandonment of a project when it believes that such action will maximize firm value. Thus management's decision to delay abandonment is not the result of regret aversion or some other psychological phenomenon. On the contrary, by minimizing reputation costs, management is acting in a manner entirely consistent with firm value maximization.

The reputation of each firm, x , can be viewed as a mapping from

$$R_N \rightarrow R_x \quad R_x = G(L, M, H, S, I, \dots)$$

Where the N parameters are such factors as:

- L - Longevity of the corporation
- M - Managerial quality
- H - History of successful projects
- S - History of successful projects in a specific area
- I - Recent indications of success, etc.

Although no attempt is made here to provide an exhaustive list, it is sufficient to assume that cer-

tain factors exist which affect the reputation of the firm and that this reputation influences the decisions of stakeholders.

New projects are taken by the stakeholders to be consistent with a past history of similar projects completed by the firm. The announcement of a new project that is consistent with an historical line of similar projects reaffirms the reputation of the firm. Specifically, if the firm has had a history of successes in a particular product line then the announcement of a new project within that line will tend to enhance the firm's reputation. Contrarily, the announcement of a new project that is a departure from past product involvement will only peripherally affect the reputation of the firm.

Therefore, the announcement of a new project, P^* , in an endeavor where the firm has an established reputation, is assumed to have a more substantial effect on the reputation of the firm than the announcement of a new project, P^{**} , in an area that represents a new venture. Specifically;

$$\frac{\partial R_x}{\partial P^*} \geq \frac{\partial R_x}{\partial P^{**}} \geq 0 \quad (1)$$

Thus, any decision by management to accept or continue a project has an effect on the value of the firm, due not only to the implementation of a positive NPV project, but also to the present value of the marginal change in earnings resulting from the reputation effect.

Assume that at time t_0 the firm initiates an investment project that will be completed at time T . Expenditures for the project will be generated throughout the development or construction time and can be represented as a continuous flow of expenditures, $C(t)$. The value of the project upon completion can be represented by $V(T)$ and so the standard Net Present Value decision rule for whether or not to enter into such

a project could be expressed as, invest if:

$$\frac{V(T)}{e^{iT}} \geq \int_0^T \frac{C(\tau)}{e^{i\tau}} d\tau \quad (2)$$

where i is the appropriate discount rate.

At any point, \hat{t} , during the project the expenditures to date can be expressed as;

$$E_{\hat{t}} = \int_0^{\hat{t}} C(t) dt \quad (3)$$

and likewise, management can anticipate future costs of

$$F_{\hat{t}} = \int_{\hat{t}}^T C(\tau) d\tau \quad (4)$$

It would be expected that;

$$\frac{\partial E}{\partial t} > 0, \frac{\partial F}{\partial t} < 0 \quad (5)$$

At each point during the development of the project, management has the opportunity to evaluate the progress achieved and decide whether or not to continue the project. An optimal decision rule is therefore required which can be sequentially applied during the development of the project using the information available.

Assume that at each point in time, t , during the project management can accurately assess the final value of the project $V(t)$ if completed, given their knowledge of the project at time t . As the project is continued, new information will continuously be generated that will impact the assessment $V(t)$. This can be represented as a Wiener process (see Roberts and Weitzman [15]) where each new value $V(t)$ is a random draw from a normal distribution with mean $V(t_i)$ and standard deviation $\sigma(t_i)$, and where t_i is the time of the immediate past assessment.

As an approximation we will further assume that;

$$\frac{\partial \sigma(t)}{\partial t} < 0 \quad ; \quad \sigma(T) = 0 \quad (6)$$

the standard deviation of the new assessment will decrease as the project nears completion and that the value of the project will be known with certainty when the project is complete.

Therefore, at time t , management should proceed with the project as long as³;

$$F_t \leq E[V(T) | V(t_i)]$$

where $V(t) \sim N[V(t_i), \sigma(t_i)]$ (7)

or ;

$$F_t \leq \frac{\int_{v^*}^{\infty} V(\tau) f(V(\tau)) dV}{\int_{v^*}^{\infty} f(V(\tau)) dV} \quad (8)$$

Equation (8), however, does not consider the reputation costs that would be incurred should the project be abandoned. Let the reputation costs at time t be represented by $H(t)$. We can assume that;

$$H(0) = 0, \text{ and} \quad (9)$$

$$\frac{\partial H(t)}{\partial E_t} \geq 0$$

since there would be no reputation cost if the project has not begun and since the effect on the reputation would increase as expenditures on the project increase.

We will further assume that each project can be categorized by a factor, θ where a high value of θ would indicate a project consistent with the type of projects upon which the firm has developed its reputation. The reputation costs are not known with certainty by management but can be viewed as the present value of the stream of anticipated increased costs from stakeholders.

$$H(t) = \int_t^{\infty} \frac{h(\tau, \theta)}{e^{i\tau}} d\tau \quad (10)$$

Where $h(t, \theta)$ represents the increased costs at time t due to the loss of reputation from the announcement of abandonment and where $h(t, \theta)$ is assumed to monotonically increase in θ .

Incorporating the reputation costs into Equation (8) gives the reputation adjusted net present value criterion for continuation of a project; specifically continue the project if,

$$F_t \leq \frac{\int_{v^*}^{\infty} V(\tau) f(V(\tau)) dV}{\int_{v^*}^{\infty} f(V(\tau)) dV} + \int_t^{\infty} \frac{h(\tau, \theta)}{e^{i\tau}} d\tau \quad (11)$$

We can now determine the value V^* such that the firm would optimally abandon the project given the current valuation $V(t)$ and the reputation cost $H(t)$. V^* represents the value assessment of the project where management would be indifferent between continuing the project or abandoning it. In other words the RA-NPV criterion could be restated as terminate the project if $V(t) < V^*$.

From (11) we see that the value of V^* will solve the following equation:

$$\int_{v^*}^{\infty} \{V(\tau) - F(t) + H(t)\} f(V(\tau)) dV = 0 \quad (12)$$

During the development of the project uncertainty exists concerning the value of the project so that $\sigma(t) > 0$. This implies that the expected value of $V(t)$ will be equal to $F(t) - H(t)$ only when V^* is less than $F(t) - H(t)$ but will approach $F(t) - H(t)$ as $\sigma(t)$ becomes small. Thus the anticipated remaining cost of the project is offset by the potential reputation cost of abandonment.



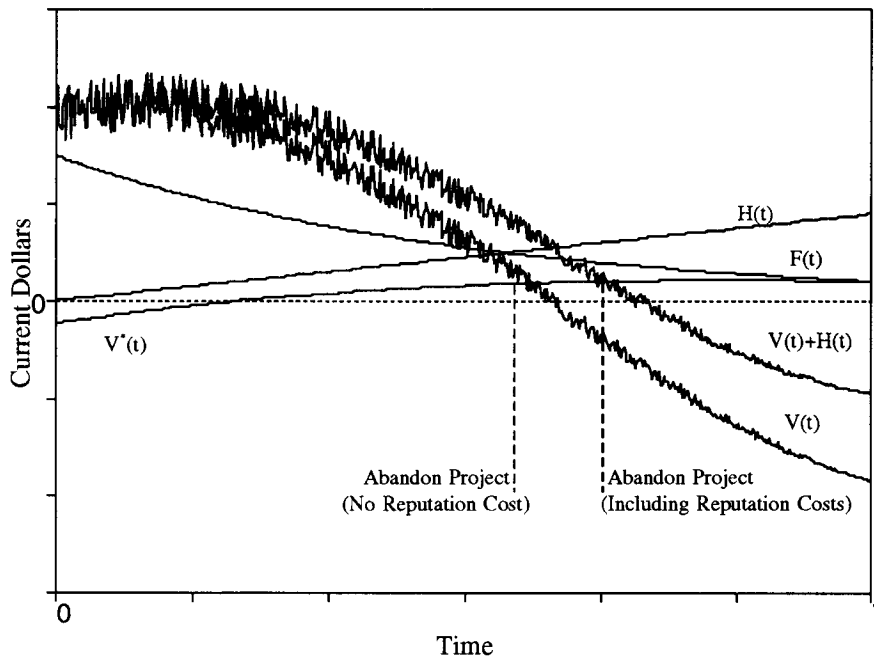


Figure 1 Relative Project Abandonment Points

The effects of incorporating the reputation effects into the abandonment decision can be seen in Figure 1. As can be seen, the variance of the information on the project's value decreases over time. The total remaining costs, $F(t)$, decrease as the project nears completion but the reputation costs, $H(t)$, increase through-out the project. The value, V^* , below which it is optimal to abandon the project, increases toward $F(t)$ as the uncertainty of the final value of the project decreases. Clearly, the incorporation of the reputation costs, $H(t)$, delays the abandonment decision.

Note from (12) that even if $H(t) = 0$ (no reputation cost) it would still be optimal to continue some negative net value projects since early in the project, when $\sigma(t)$ is large, the value of V^* can be negative. With no reputation costs these projects would likely be dropped however, since as the project continues, $\sigma(t)$ becomes

smaller. With the existence of a positive $H(t)$ and where $H(t)$ increases in magnitude with time, the effect of the decreasing $\sigma(t)$ is offset and it would be optimal to continue negative NPV projects longer and with even larger negative values. Clearly, the larger the value of $H(t)$ the more negative the NPV could become and still lead the manager to continue the project. As can be seen from Equation (12), if there are no reputation costs, $H(t) = 0$, and if there is no uncertainty about the final value of the project (i.e. $V(t) = V(T)$ always) then the RANPV rule becomes simply abandon if $F(t) < V(t)$ which is the standard net present value criteria for project termination.

Management will continue a project whenever the RANPV criterion is met. If the abandonment announcement will have a negative impact on the reputation of the firm, management may continue with a negative NPV project.

Further, given Equation (1), management will tend to delay the abandonment of a mainstream project for longer than it would a new venture.

The asymmetry of information between management and stakeholders concerning the true value of the project is the factor that drives this result. Let the asymmetry of information be represented by q , where q is a real valued element from the interval $[0,1]$. Also assume that $q = 0$ represents full knowledge by the stakeholders of the viability of the project and $q = 1$ represents no knowledge by stakeholders other than the fact that the project is being continued. Then RANPV approaches NPV as q approaches 0. All information concerning the project will be incorporated into the value of implicit claims held by stakeholders. Therefore, as they learn of the true state of the project, the costs will actually be incurred by the company. This implies that (11) can be rewritten as;

$$F_t \leq \frac{\int_{v^*}^{\infty} V(\tau) f(V(\tau)) dV}{\int_{v^*}^{\infty} f(V(\tau)) dV} + q \int_0^{\infty} \frac{h(\tau)}{e^{i\tau}} d\tau \quad (13)$$

and (12) becomes;

$$\int_{v^*}^{\infty} \{V(\tau) - F(t) + qH(t)\} f(V(\tau)) dV = 0 \quad (14)$$

If q is initially near 1 when the NPV goes negative, but information about the project gradually leaks i.e. $dq/dt < 0$, then the project will be abandoned sooner than if no leaks occur. Also as discussed above, the reputation costs associated with an abandonment announcement will be related to stakeholders' perceptions of the importance of the project in relation to overall firm value. The abandonment of a project that is not closely linked to the firm's main line of business

(θ small in (10)) will result in relatively lower reputation costs, and will consequently be abandoned more readily, than a 'flagship' project. Thus we would expect to find a direct relationship between the 'significance' of a project and the delay in its abandonment.⁴

Thus the two factors that determine the length of delay in abandonment of a negative NPV project are: (1) the initial degree of informational asymmetry and the rate at which information concerning the true value of the project leaks to stakeholders; and (2) the effect that a given project is perceived to have on the reputation of the firm, i.e. whether the project is mainstream or a new venture.

$$\frac{\partial V^*}{\partial q} < 0 ; \frac{\partial V^*}{\partial \theta} < 0 \quad (15)$$

Equity Value Implications

The impact of an abandonment announcement on the firm's equity market value will depend upon the interaction of the above factors. For example, if $q = 1$ (i.e. complete informational asymmetry) at the time of announcement, then the reputation effect of the abandonment will tend to decrease share price to an extent determined by stakeholders' conceptions of the significance of the project ($H(t)$). Conversely, if q has decayed to the point where $q = 0$ at the time of announcement then any negative reputation effects will already be fully reflected in share price and the abandonment announcement will relay positive news to the market; namely that the firm is discontinuing a negative NPV project.

Between these two extremes lies the more realistic scenario in which $1 > q > 0$. Partial information concerning the true value of the project leaks to stakeholders over time but has not

yet reached full information. Assuming management acts to maximize current share price, it will announce the abandonment of a negative NPV project when to do so would not decrease share price further. Thus, assuming management is able to accurately gauge shareholders' beliefs reflected in the parameter θ , and the degree to which information asymmetry exists, q , an abandonment announcement should have no effect on share price. The negative reputation effects of the abandonment announcement should exactly counterbalance the positive announcement effect resulting from management's decision to discontinue a negative NPV project. This prediction is consistent with an empirical study by Owers and Rogers [13] who find that, on average, the market-adjusted return following an abandonment announcement is insignificantly different from zero.

If management is unable to accurately gauge stakeholder beliefs and information asymmetry, or if management is not acting to maximize share price, then observed announcement effects of project abandonments may diverge from the above prediction.⁵ To the extent that the abandonment announcement, in and of itself, resolves uncertainty, it may tend to increase equity market value. This is due to the "attention hypothesis" of Grinblatt, et al. [6] who observe a positive announcement effect from stock splits and stock dividends. Firms only choose to draw attention to themselves when they believe such attention will be beneficial. Similarly, Ross [16] observes that an earlier than expected resolution of uncertainty may, in and of itself, increase stock price.

Conclusion

The success of any business organization depends upon its ability to identify and complete profitable investment projects. To the extent that there is uncertainty among stakeholders

concerning management's ability in this regard, the abandonment or continuation decision of capital budgeting may act as a signal. A firm that invests its resources successfully, i.e. completes positive NPV projects, will accumulate reputational capital in the form of an increase in the value of implicit claims sold to stakeholders.

An abandonment announcement can tarnish this reputation. Management may therefore defer the decision to abandon a project temporarily to deceive stakeholders about the project's true worth. Even though the true value of the project may eventually be revealed, firm value will be maximized by delaying the revelation of the projects true worth for some time.

Consequently, the timing of an abandonment announcement is not determined solely by management's beliefs regarding the NPV of a project. Rather it has to do with management's perception of the effect that an abandonment announcement will have on firm value. Management will abandon a project when it believes that the information released by such a decision will act to maximize firm value.

A recent example, on a divisional level, is provided by Pan Am Corp. In the late 1980s, Pan Am began to face serious problems in meeting its sizeable debt obligations. Paradoxically, in an attempt to alleviate these liquidity problems and streamline the company, Pan Am sold off its profitable divisions while retaining its unprofitable division. It sold the Pan Am building in New York, the Intercontinental Hotel chain, and its Pacific air routes, all of which were profitable enterprises. It retained the unprofitable trans-Atlantic air routes because these have traditionally been Pan Am's business core. Pan Am's strategy, therefore, may have been an attempt to minimize reputation costs by continuing the business that, in the eyes of investors and other stakeholders, identifies the company.

Similar strategies have been followed by Harley Davidson Corp. and Rolls Royce PLC. Both organizations have in the past retained unprofitable flagship divisions (motorcycles and cars respectively) by diverting profits from other divisions (defence contracting and jet engines respectively). At times these flagship divisions would not have passed the standard NPV criterion for continuation. Both companies realized, however, that substantial reputation costs would be incurred if they were abandoned. In choosing to continue these product lines management applied a reputation adjusted NPV (RANPV) criterion as outlined above. Their choice has now been vindicated since Harley Davidson motorcycles and Rolls Royce cars are once again profitable divisions.

The experience of these two companies highlights the other implication of the RANPV criterion that was discussed. The longer a project's termination is delayed, the more the opportunity exists for the conditions making the project's NPV negative to change. Therefore mainline projects will tend to ultimately succeed more than new ventures because management will continue to pursue the mainline project that has a negative NPV, but positive RANPV, while abandoning the new venture with the both negative NPV and RANPV.

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End Notes

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² For example, Staw and Ross [1987] note that a certain social esteem accrues to those individuals who "stick to their guns" (P. 59) in the face of adversity. Staw et al. note that managers who, when faced with losing situations, "stay the course" or "weather the storm" and are ultimately vindicated tend to be more highly revered than managers who stick closely to the rules dictated by economic rationality, such as the NPV rule. An example of such reverence is that recently paid to Lee Iacoca following his dogged resurrection of Chrysler Corp. in the early 1980's.

³ See Roberts and Weitzman [1981] for a thorough development of this model.

⁴ Lockheed's considerable delay in terminating its L-1011 aircraft project provides a good example of this (see Reinhardt [1973]), as does Exxon's minimal delay in eliminating its office products division after it performed poorly (office products are not Exxon's main line of business).⁵ For example, in a recent study, Statman and Sepe [1989] find that 40 out of 70 abandonment announcements result in positive market-adjusted returns. In addition, they find that "returns are especially high when a large portion of the information about the poor prospects of the project has been known to shareholders before the termination announcement" (p.80). Statman et al.'s findings, therefore, are entirely consistent with our model's predictions when q is near 0.

Biographical Sketches

Johnson Dobson is a business ethics consultant and an Associate Professor of Finance in the College of Business at California Polytechnic State University, in San Luis Obispo, California 93407. His primary research interests are Agency Theory, and Financial Ethics. His publications include articles and letters in *Journal of Business Ethics*, *Financial Management*, *Financial Analysts Journal*, *Journal of Economics and Finance*, *Business in the Contemporary World*, *Business and Society*, and *Business and Professional Ethics Journal*.

Robert Dorsey is an Assistant Professor of Economics and Finance at the College of Business at the University of Mississippi, University, MS 39677. His primary research interest is decision making in financial markets and is currently working with neural networks within the context of experimental markets to model human decision making. Prior to recently beginning a career in academics he worked as a mining engineer, a physicist and a university administrator. He has degrees in both physics and economics from the University of Arizona.
