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### Citation for published version:

Armitage, S 2008, 'Incorporating financing-related determinants of value in the discounted cash flow model', *Journal of Economic Surveys*, vol. 22, no. 2, pp. 274-298. <https://doi.org/10.1111/j.1467-6419.2007.00535.x>

### Digital Object Identifier (DOI):

[10.1111/j.1467-6419.2007.00535.x](https://doi.org/10.1111/j.1467-6419.2007.00535.x)

### Link:

[Link to publication record in Edinburgh Research Explorer](#)

### Document Version:

Peer reviewed version

### Published In:

Journal of Economic Surveys

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**Incorporating financing-related determinants of value in the discounted cash flow model**

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**Pre-publication draft, November 2006**

*Journal of Economic Surveys* 22, 2008, pp. 274-98

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# **Incorporating financing-related determinants of value in the discounted cash flow model**

## **Abstract**

The paper discusses how some of the main types of interaction between financing and value can be incorporated in the discounted cash flow model of valuation, including effects arising from taxes, transactions costs, disclosure, information asymmetry and agency problems. It explains whether a given effect should appear in a project's cash flows, in its cost of capital, or as an up-front adjustment to value. Most of the effects imply that the principle of value additivity does not hold.

JEL classifications: G32, G12

Keywords: discounted cash flow; financing effects; project valuation

## **1. Introduction**

Theories regarding financing have been developed to explain various features of firm organization and financial contracts, and to explain firms' choice of capital structure and dividend policy. Financing arrangements are seen as important partly - perhaps mainly - because they are predicted to have an impact on values and real investment decisions. But it is not always obvious how the effects of financing should be captured in valuation models.

The purpose of the paper is to offer an account of how some of the main types of interaction between financing and value can be accommodated in the static discounted cash flow (DCF) model. The paper is concerned with conceptual organization and clarification; it makes more explicit certain aspects of what financing implies for valuation. Several types of interaction are considered in turn, and in each case the nature of the effect is summarized and a suggestion is made about how the gain or loss in value from the interaction should appear in

the DCF model. The interactions to be considered are prominent explanations for a company's choice of leverage, dividend-payout policy and level of disclosure; the costs of raising capital; and certain effects arising from information asymmetry and from agency problems. The perspective taken is that of a disinterested person, with full information about the project and the effects of its financing. The aim is to explain how such a person would show the effects explicitly in the DCF model.

The main points to emerge are as follows. First, an effect can appear in the project's cash flows, in its cost of capital, or via the device of an up-front adjustment to the present value. We shall argue that transactions costs and agency effects should appear in the cash flows, and that tax effects and any impact on the risk or liquidity of the securities issued should be captured in the cost of capital. An up-front adjustment to value is called for in cases of interaction stemming from information asymmetry. The adjustment captures the gain or loss to shareholders that arises from financing the project via the issuance of a financial asset at a value that differs from the full-information value of the asset, or via not repurchasing undervalued equity.

Second, since most of the interactions affect the project's cash flows or its cost of capital, we need to be careful about what it is that is valued. An established theoretical framework for valuation is that which assumes the existence of contingent states, ie possible future states of the world. The DCF model can be described as a summarized version of the contingent-states framework. In this framework a project *is* a set of contingent cash flows. Its present value is found by multiplying the cash flow arising in each contingent state by the discount factor applicable to that state (see, for example, Danthine and Donaldson, 2005). Equivalently, the value is found by discounting the expected cash flow for each future date by the project's cost of capital, as in a standard DCF calculation. Therefore any change in financing or parent company of a project that causes its contingent cash flows or the relevant

discount factors to change results in theory in a different project, in the sense of a different entity to be valued.

The issue of precisely how to show the effects of financing and parentage on value is usually sidestepped by assuming that the company or project arrives for valuation with the financing arrangements that maximize its value already in place. For example, Ehrhardt (1994) states at the start of his book *The Search for Value* that ‘the emphasis ... is *not* on the selection of optimal capital structure. Throughout this book, it is assumed that your capital structure is fixed’ (p. 6). Similarly, Brealey and Myers (2003) argue that a given project will have its own ‘debt capacity’, ie its own optimum leverage or amount of debt given its total value. However, if we want to discuss how to incorporate the effects of financing and parentage in the DCF model, we must discard the assumption that a project arrives for valuation with the effects already built in. What we then have is something that results in an asset that can be valued using DCF when combined with a financing package and parent. We shall retain the term ‘project’ for this something with the potential to produce a particular set of contingent cash flows, and use the term ‘real asset’ for a realized set of contingent cash flows, which can be valued. Then we can say that a given project combined with a different financing package or parent results in a different real asset.

The third point is that in most cases the nature of the financing interaction implies that the principle of value additivity does not apply. These cases include the effects on value of leverage, dividend payout, disclosure and asymmetric information. When any of these interactions are introduced, features of the parent make a difference in theory to the value of the parent-project combination, because of the interaction. Therefore, the value of the parent-project combination can not be obtained by valuing the parent and project separately and adding the two values.

The paper proceeds by considering several types of interaction in turn. The conclusion summarizes how each interaction should appear in the DCF model.

## **2. Financing interactions in the DCF model**

### **2.1 Trade-off theory of leverage**

The trade-off theory recognises two factors related to financing which affect a project's value, namely the tax advantage to debt and the expected costs of financial distress and bankruptcy. The representation of the trade-off theory in DCF will be known to many readers, but it helps to start the discussion in familiar territory. There are in fact many versions of the theory, depending on the specific assumptions made. Our purpose is to establish the framework within which the effects on value of any of the versions can be displayed.

The existence of a tax advantage to debt is based on the fact that profit, which accrues to shareholders, incurs corporation tax, whereas interest on debt does not. In conventional DCF analysis, the tax advantage is captured in the tax-adjusted weighted average cost of capital (WACC):

$$WACC = R_D(1 - T_C)L + R_E(1 - L) \quad (1)$$

where  $R_D$  is the cost of debt, assumed to be paid in the form of interest which can be set against taxable profit;  $T_C$  is the effective rate of corporation tax relieved by the interest, discussed further below;  $R_E$  is the cost equity; and  $L$  is the project's leverage measured as the market value of debt divided by the total market value of the debt and equity. The fact that WACC is defined as in (1) is due to the accompanying definition of the expected cash flows to be discounted, in which the cash flows ignore debt and are net of corporation tax estimated ignoring interest. These cash flows do not incorporate the tax advantage to debt. If the cash

flows to be discounted were net of corporation tax allowing for interest, they would incorporate the tax advantage, and there would be no  $(1 - T_C)$  adjustment to WACC.

The formula in (1) is only correct if it is assumed that leverage, measured using market values, is constant for the life of the project. The implied discount rate for the tax savings is hidden in the cost of equity, because the assumption made regarding the risk of the tax savings affects the relationship between the cost of equity and leverage. The relationship between WACC and leverage also depends on whether the cash flows are perpetual or finite and on whether debt is treated as riskless or risky.<sup>1</sup>

Allowing for personal tax may mean that the rate of tax advantage is less than  $T_C$ . If personal taxes paid by a company's shareholders and lenders are such that the total tax burden including personal tax is the same for equity and debt, we have

$$(1 - T_D) = (1 - T_C)(1 - T_E)$$

or 
$$T_D = T_C + T_E - T_C T_E \tag{2}$$

where  $T_D$  is the personal tax rate on debt and  $T_E$  is the personal tax rate on equity. In this case there is no tax advantage to debt and, if  $T_C$  is constant with respect to leverage, WACC is constant with respect to leverage, just as in the no-tax context. Yet, confusingly, the WACC formula remains as in equation (1). This is because it remains true that interest on debt saves corporation tax and that the tax saving is not captured in the cash flows.

Both the cost of debt and the cost of equity are expressed before personal tax in (1). So the tax disadvantage to debt at the level of personal tax appears in the values of  $R_D$  and  $R_E$  in the WACC. The  $(1 - T_C)$  adjustment in (1) is always correct, given cash flows net of corporation tax estimated ignoring interest, but it does *not* imply that debt has a tax advantage at the rate  $T_C$ . The tax advantage to debt, if any, depends as well on the personal tax rates implicit in  $R_D$  and  $R_E$ , and is not explicit in the WACC formula. For example, if certainty is assumed and (2) holds,  $R_D = R_E / (1 - T_C)$ . That is, the cost of debt before personal tax must be

*higher* than the cost of equity, by the percentage that exactly offsets the corporate tax advantage to debt. Since some of the return on shares is in the form of capital gains, and effective rates of capital gains tax are less than effective rates of income tax in most countries, we would expect  $T_D$  to exceed  $T_E$ . Armitage (2005, ch. 9) and Graham (2003) review research on the tax advantage to debt allowing for personal taxes.

The costs of financial distress are incremental costs that are caused by the condition of being in distress. An increase in leverage at a given date reduces the project's present value, other things equal, because it increases the probability that the project will enter financial distress, and possibly increases the severity of the distress. Though it is conventional to capture the tax advantage of debt in WACC, it is not conventional to incorporate the expected costs of distress arising from debt in WACC.<sup>2</sup> So these costs must be incorporated in the contingent cash flows. Since the costs of distress alter the contingent cash flows, they could, in principle, alter the risk of the cash flows. If so, they will alter the project's cost of capital as well as the contingent cash flows. The same point applies to other financing effects that alter cash flows.

Under the trade-off theory, a given project has an optimum level of leverage, at which the present value is maximised: the gain in value from the tax advantage attributable to an additional unit of debt is equal to the loss in value from the expected costs of distress. At the optimum there will be a tax advantage to debt allowing for personal tax; so equation (2) will not hold if the trade-off theory holds and the expected costs of distress are positive.

The literature recognises that companies and projects differ in the rate at which the expected costs of distress cause value to be lost as leverage is increased. For example, we would expect the rate of loss to be positively related to the proportion of value accounted for by intangible assets. It is also argued that the marginal present value of the tax advantage will start to decrease as leverage increases, because higher leverage makes it more likely that, in



some possible future states, not all the interest can be applied to reduce taxable profit (DeAngelo and Masulis, 1980; Graham, 2000). The decline in the marginal value of the tax advantage depends on the project-specific distribution of contingent taxable profits before interest. This argument implies that the rate  $T_C$  to use in equation (1) for a given project will depend in part on its level of leverage, becoming less than the statutory rate of corporation tax beyond a certain leverage. Graham (2000) presents evidence that most US firms are substantially less levered than they would need to be for the firm-specific marginal  $T_C$  rate to be low enough for (2) to hold. The personal tax rates  $T_D$  and  $T_E$  are also be linked to project-specific characteristics in some models; see Green and Hollifield (2003) or Dammon (1988).

If leverage affects value, then in theory a project is not an asset whose value can be measured until we know its leverage, because it is not yet a set of expected cash flows and the cost of capital is not fully determined.<sup>3</sup> Rather, a project is a cash flow generator that produces expected cash flows and an associated cost of capital when the leverage is specified. It makes little sense to try to think of a ‘pure’ project which we can value without specifying its leverage, because we would not know what its cash flows or cost of capital were supposed to be. A project could, for instance, be valued using cash flows forecast on the assumption that it proceeds on a stand-alone basis and is funded entirely by equity. But we would still have specified the parentage (none, or an entrepreneur) and the financing (equity).

The optimum leverage will differ across projects in a way which is linked to those characteristics of the project that determine how the marginal expected costs of distress rise with leverage and how the marginal tax advantage falls. Using the term ‘real asset’ to indicate a set of contingent cash flows, we can say that a change in a project’s leverage implies a change in the real asset to be valued.

### *Effect of parent under the trade-off theory*

In the standard treatment of capital budgeting it is argued that all projects should be valued on a stand-alone basis (eg Brealey and Myers, 2003, pp. 177-8). Characteristics of the parent or owner do not affect value (assuming that all owners seek to maximise shareholder wealth). The reason is that the principle of value additivity is assumed to hold, which states that the value of a company is given by the sum of the present values of the projects owned by the company, with each project valued on a stand-alone basis. The argument for the principle can be put briefly as follows. In the contingent-states setting, a cash flow which will arise in a given state is discounted by the discount factor applicable to that state. If another cash flow is added in that state, the sum of the two is discounted using the same discount factor. Therefore, the covariance between the cash flows of any two projects does not affect the value of the two combined.

Appeal to the notion of a project's optimum leverage or debt capacity might be thought sufficient to make valuation under the trade-off theory consistent with the principle of value additivity. Each project is viewed as having its own optimum leverage as a separate entity, and each can be valued separately assuming its leverage is at the optimum. A company is then merely a collection of projects, and its leverage is the weighted average of the leverages of its constituent projects, with the weights being the market value of each project (debt plus equity) divided by the company's market value. We note in passing that the idea that a company's leverage is a by-product of the optimum leverages of its constituent projects does not sit easily with the idea that a company operates with its own target leverage, which determines the leverage of the projects it undertakes. In the latter case the leverage of a given project will depend on the chosen target leverage of its parent, and could be different if it had a different parent: value additivity does not hold. The two positions can be reconciled if it is assumed that a given company's projects will be similar, at least in their optimum leverage.

But value additivity clearly does not hold in the context of the trade-off theory even if the idea is accepted that a project has its own optimum leverage on a stand-alone basis. The market value of a project combined with its parent company depends partly on the present values of the tax shield and of the costs of distress under the trade-off theory, and these values are both affected by the covariance between the cash flows of the parent and the project. Assume for simplicity that profit before interest is the same as cash flow. Since the combined interest cost for two projects is a fixed total across the contingent states, the expected amount of tax relief obtained will be negatively related to the variance of the combined cash flow, assuming that the expected value of the combined cash flow exceeds the interest cost or is not too far below. The expected tax relief will therefore be negatively related to the covariance between the two cash flows. As a result, we can no longer value the combination of two projects simply by adding up the separate cash flows after tax in each contingent state and discounting the total by the relevant discount factor.

Consider an example. Project A has issued debt and will provide cash flow before interest of \$200 in contingent state 1 and \$50 in state 2. The interest on A's debt is \$100 in both states, so \$50 of interest does not relieve tax in state 2. Project B has no debt and will provide \$50 in state 1 and \$0 in state 2. In this case the covariance of the cash flows is positive, and adding project B to A does not result in a higher tax saving for the two combined than the sum of the tax savings for the two as separate entities. Now consider project C which has no debt and provides \$0 in state 1 and \$50 in state 2. In this case the covariance is negative, and adding C to A does result in a higher tax saving for the two combined.

This effect is reinforced when we bring in the costs of financial distress. Assume that the state of being in distress begins after cash flow after interest (if any) has been negative for a certain length of time. Then the expected cost of distress for the parent-project combination

will be positively related to the variance of the combined cash flow. In fact this is the case even in the absence of debt.

Thus, the incremental cash flows attributable to a given project will depend in part on the existing contingent cash flows of the parent, as will the optimum leverage of the parent-project combination. A project's debt capacity is not defined, in theory, without specifying the contingent cash flows and debt of the parent. The value of a given project varies across potential parent companies; a different parent results in a different real asset. These straightforward points rarely feature in textbooks, perhaps because they are taken to be of second-order importance.<sup>4</sup>

We can now summarise the effects of leverage in the DCF model under the trade-off theory. By convention, the present value of the savings of corporation tax due to debt is captured via the discount rate, by inserting the appropriate  $T_C$  rate in the tax-adjusted WACC formula. The expected costs of distress appear in the expected cash flows. The covariance between the cash flows of a company and a project affects the expected tax savings and costs of distress of the combined entity. The covariance therefore affects the optimum leverage and the value of the combination. Thus, the value of a given project is affected jointly by the contingent cash flows of the parent company, if any, and by leverage. A change in parent or leverage for the project results in a different real asset to be valued via DCF.

## **2.2 Dividend payout policy**

Under a common view of dividend payout policy, companies trade off the tax disadvantage of paying dividends against the net non-tax advantages. A tax disadvantage exists if the effective rate of income tax on dividends exceeds the effective rate of capital gains tax. As noted above, it is conventional for the costs of equity and debt to be expressed before personal tax. So in theory the tax disadvantage will mean that the cost of equity is

positively related to the proportion of profits after corporation tax that is paid out as dividends. The tax disadvantage may be assumed to be constant across companies, or it may be assumed that tax clienteles exist. In the latter case the shareholders of high-payout companies will face lower rates of income tax than the shareholders of low-payout companies, and the tax disadvantage will be less or zero for high-payout companies. However, Allen and Michaely's (2003) assessment is that 'the evidence from the ex-[dividend] day studies appears to indicate that from a tax perspective, dividends should be minimised' (in the USA).<sup>5</sup>

The question arises of how the tax disadvantage to dividends is captured in methods of estimating the cost of equity. There are two types of method. One type regresses the returns on the share against percentage changes in the values of a risk factor or factors. The expected return on the share is then given by the risk-free rate plus the sum of the share's beta coefficient for each risk factor multiplied by the relevant factor risk premium. Methods of this type include the CAPM and multifactor models. Estimates using these models will be gross of personal tax, assuming that the risk-free rate and the factor risk premiums are estimated gross of personal tax. But conventional applications do not include a term reflecting dividend yield or payout, so they do not capture variations in expected returns across shares due to difference in payout. Brennan's (1970) CAPM augmented to allow for personal tax does include a dividend-yield term, but it has not become part of the accepted techniques for estimating the cost of equity.

The second type of method involves inferring the cost of equity from the current share price and some estimate of the future cash flows to equity. Methods of this type include the dividend discount model re-arranged and the abnormal earnings method. Five variants are compared in Botosan and Plumlee (2005). Since these methods rely on the share price, and the share price will reflect any tax disadvantage to anticipated dividend payments, methods of

the second type do, in principle, capture variation in expected returns across shares due to differences in payout.

A major non-tax advantage hypothesised from paying dividends is the agency benefit that the payments increase present value by reducing the free cash holdings in the company which might otherwise be vulnerable to being squandered by management. A non-tax disadvantage to payout is the additional transaction costs of having to raise more external equity over time than if payout were less. The optimum payout ratio is the ratio at which the present value of the tax disadvantage attributable to a marginal increase in payout is equal to the value of the net non-tax benefit.

It can be argued that the optimum payout ratio will be linked to company-specific characteristics. For example, we might expect the net non-tax benefit to be negatively related to the proportion of the company's value accounted for by growth opportunities, since the value of growth opportunities is likely to disappear more rapidly than the value of tangible assets if the company becomes short of cash (eg Barclay et al, 1995). As another example, the agency benefit of payout should be greater for companies with widely held shares and without a large shareholder who has the incentive and influence to monitor management carefully.

If we consider projects as opposed to companies, the notion of a single project with an optimum dividend payout policy is strained: more strained than the notion of a project with an optimum leverage. It seems dubious to try to think of a single stand-alone project as having a payout policy or 'dividend capacity'. The presumption for a stand-alone project is that it pays out all its cash flows to the owner when the cash becomes available. It only makes sense to think of payout policy in the context of an ongoing company which is making repeated investments in new projects, and which therefore faces a repeated choice between payout and retention. Given this, the parent company's payout policy will have an impact on a given

project's value, and the question then is how to accommodate the impact in the DCF valuation of the project.<sup>6</sup>

If there is a tax disadvantage to dividend payout, and the company pays dividends, then the cost of capital it uses to value its projects should in theory reflect the tax disadvantage, though whether it does in practice depends on the method used to estimate the cost of equity. Let us assume that the non-tax effects of payout are the cost of raising additional external equity and the reduction in the scope for value-destroying investment by management. We argue in Section 2.4 that the cost of raising equity should appear as an addition to the up-front cost of the project. If we assume that the company operates with a target payout ratio, the proportion of equity raised externally will be treated as constant across projects, and an estimate of the issuance cost per dollar of the external equity for the project can be added to the up-front cost.

The agency benefit implies that, if payout were zero, a proportion of each cash flow would effectively be lost because the cash would be invested in a way that destroyed part of its value. Thus, a clear way of showing the benefit of a given payout ratio is to discount cash flows  $Y_t^*$  adjusted for the agency loss given zero payout and the benefit of payout:

$$Y_t^* = (a_{zp} + b_p)Y_t; \quad (3)$$

$$0 \leq a_{zp} \leq 1 \text{ and } 0 \leq b_p \leq 1$$

where  $Y_t$  is the unadjusted expected cash flow from the project for date  $t$ ,  $a_{zp}$  is the estimated proportion of the cash flow which contributes to the present value for shareholders assuming zero payout,  $1 - a_{zp}$  is the proportion which will be lost due to value-destroying investment of the cash flow at date  $t$  or later, and  $b_p$  is the estimated proportion that will be saved from loss due to the effect of payout ratio  $p$  on management behaviour. The values of both  $a_{zp}$  and  $b_p$  will depend on the parent company.

Another way of showing the benefit of payout would be to include the benefit as an up-front adjustment to present value, so that the present value  $PV^*$  allowing for the mitigated agency loss is

$$PV^* = (\alpha_{zp} + \beta_p)PV; \quad (4)$$

$$0 \leq \alpha_{zp} \leq 1 \text{ and } 0 \leq \beta_p \leq 1$$

where  $PV$  is the present value ignoring the loss due to value-destroying investment of the cash flows,  $1 - \alpha_{zp}$  is the proportion of value which would be lost due to value-destroying investment were payout zero, and  $\beta_p$  is the proportion saved from loss due to the effect of payout. But this representation obscures the fact that the agency benefit of payout is realised in the form of higher values of future cash flows to be discounted.

The foregoing comments suggest that the impact of payout policy on value can be accommodated in a similar way to the impact of leverage. The present value of the tax disadvantage due to payout is obtained in the DCF calculation by use of the appropriate cost of equity before personal tax in the WACC formula. The expected net non-tax benefits of payout will appear in the cash flows, including the implied incremental up-front cost of raising external equity. The value of a given project will depend to an extent on features of the parent, including the tax disadvantage it faces per dollar of dividends, its costs of raising external capital, agency costs in the company, and its payout policy. A change in payout policy or parent for the project results in a different real asset to be valued.

### **2.3 Disclosure**

The impact of disclosure policy on value can be treated in a similar way to that of payout policy. It has been argued that a company's value will be positively related to the amount and quality of information it discloses about itself to investors and lenders (see Healey and Palepu, 2001, for a review). A positive effect is hypothesised to arise via a



reduced cost of capital, as a result of greater liquidity for the shares and lower estimation or information risk, ie less uncertainty about future cash flows arising from lack of information. Disclosure may also reduce agency costs. The possible costs of disclosure include harmful exposure of information to competitors, staff time, and reduced flexibility regarding the choice of what to disclose in the future. As with leverage and payout, we can postulate a hump-shaped relation between value and disclosure, with a company-specific optimum amount of disclosure. The immediate purpose of disclosure is to reduce information asymmetry, so we would expect the value of disclosure for a given company to be positively related to the inherent difficulty of learning about the company.

Imagining a stand-alone project with a disclosure policy is perhaps even more of a strain than imagining a project with a payout policy. But for a project with a parent company, the value of the project will depend in part on the disclosure policy of the parent. The benefits to the cost of equity are perhaps more likely to be captured by methods of estimation that involve inference from the share price than by the CAPM or a multifactor model. Greater liquidity of the shares implies smaller transactions costs of trading and a higher share price (lower expected return gross of trading costs) at any given time, whereas the standard CAPM does not allow for variations in liquidity across shares. Also it is unclear whether estimates of beta will reflect differences across firms in estimation risk. The evidence on the link between disclosure and the cost of capital is mixed. But if there are benefits from reduced risk or reduced costs of trading, they should appear in the cost of capital.

The expected costs of disclosure, net of any agency benefits, are cash costs. Some costs are a type of overhead, such as the cost of producing annual reports. They are not incremental costs for a given project and should not be included in the cash flows. But loss of income from harmful exposure of information to competitors does affect the project's value.

The cash flows to be discounted would be  $(1 - c_{\text{disclosure}})Y_t$ , where  $c_{\text{disclosure}}$  is an estimate of the proportion of the project's cash flow lost as a result of the parent's disclosure policy.

## 2.4 Transactions costs of raising capital

The transactions or 'flotation' costs of raising capital are primarily the fees paid to banks for arranging loans and to investment banks for organising issues of securities. For a stand-alone project, it seems natural to incorporate the costs of raising the capital in the DCF model as an up-front cash cost. The cost of raising the capital is less clear-cut for a project undertaken by a parent company. One approach is to assume that the company raises a certain proportion of capital from external sources, in which case the actual source of funds for any given project and the actual cost of obtaining these funds are not relevant in assessing the project's value. This approach is consistent with the common assumptions in capital budgeting that a company operates with a target level of leverage and a target dividend payout ratio. The procedure would be for the company to estimate a typical cost of raising capital per dollar of capital invested, so the up-front increment to cover the costs of raising the capital attributable to a project would be  $c_{\text{issue}}I$ , where  $c_{\text{issue}}$  is the cost of raising external capital expressed as a percentage of the dollar amount invested in the project,  $I$ . We argue that  $c_{\text{issue}}$  is an incremental cost. A company may already have sufficient external capital to undertake a given project; it is likely to go to the capital market less frequently than it makes investments. But the external capital required for a given project will not be available for the next-best alternative, and if the capital was costly to raise, the cost should be attributed to the project.

This cost per dollar invested will be company-specific and will depend on the proportion of capital invested which the company raises externally, on the split between external equity and debt, and on the flotation costs per dollar raised of external equity and debt. The cost will be affected by the company's leverage and payout policies, and the

flotation costs per dollar raised will be linked to features of the company, for example its size, financial health, transparency and the tangibility of its assets. Once again, the value of a project is affected by features of the parent.

The alternative to making an up-front adjustment to the project's cost is to adjust the project's cost of capital for the costs of raising capital (for example, Ehrhardt, 1994, pp. 131-9). But it is clearer conceptually to show the costs of raising capital as cash costs, so that the cost of capital used is closer to being an opportunity cost.<sup>7</sup> In addition, the inclusion of capital-raising costs in the discount rate would mean that the discount rate would depend on the life of the project.

It may not be easy in practice to measure the fee for raising the capital. This is so particularly when the same institution both provides the funds and arranges or part-arranges their provision, as in the case of a bank loan or a privately negotiated placement. Consider a placement of equity by an unlisted firm after costly negotiations, in which the arrangement 'fee' for the investor is obtained via payment of a lower price for the equity than would be the case if arranging the issue had been costless. The amount of the fee can only be estimated. It may also be hard to distinguish costs of trading from costs of supplying capital. The former contribute to the cost of capital gross of trading costs; the latter contribute to the cost of raising capital. But some of a financier's up-front fee may be compensation for illiquidity. A further point is that financial institutions provide services including monitoring of companies and sometimes intervention in management. This implies that they not only supply capital and trade financial assets, but they can also *change* the companies that have issued the assets.

## 2.5 Misvaluation due to information asymmetry

### *Stand-alone project*

This section considers a fundamentally different type of interaction, namely the effect of misvaluation by the capital market. We start with the case of a stand-alone potential project, owned by an entrepreneur who requires equity from the capital market to finance the initial cost. The entrepreneur is assumed to have better information about the project than the market, and this means that the market makes a less accurate assessment than the entrepreneur of either the project's expected cash flows or its cost of capital, or both. As a result the market's valuation is likely to differ from the 'true' or full-information valuation made by the entrepreneur.

We assume that the entrepreneur will only attempt to undertake projects which he or she believes to have a non-negative NPV. This avoids introducing agency issues at this point. There are then two possible outcomes.

(i) The market funds the project; it makes an estimate of the present value of the project,  $V_{\text{mkt}}$ , which is at least as much as the cash investment required,  $I$ .  $V_{\text{mkt}}$  may be different from the present value as assessed by the entrepreneur with full information,  $V_{\text{true}}$ , but the project goes ahead so long as  $V_{\text{mkt}} \geq I$ . Assuming that the entrepreneur only sells enough of the shares in the project to raise the amount  $I$ , the entrepreneur's gain from the project is  $(1 - I/V_{\text{mkt}})V_{\text{true}}$  measured using the project's true value. He or she must sell the proportion  $I/V_{\text{mkt}}$  of the shares in order to raise  $I$ , so the term in brackets is the proportion which the entrepreneur keeps. The entrepreneur's gain will not be the same as the net present value (NPV) unless  $V_{\text{mkt}} = V_{\text{true}}$ . The difference is the gain or loss to the entrepreneur due to selling enough of the shares at their market price to raise  $I$ , given a market value of  $V_{\text{mkt}}$ . This difference is given by  $(1 - I/V_{\text{mkt}})V_{\text{true}} - (V_{\text{true}} - I) = I(1 - V_{\text{true}}/V_{\text{mkt}})$ . Thus, to show the

effect of the market's misvaluation on the NPV from the entrepreneur's perspective, an up-front adjustment  $A_a$  to the true NPV should be added, given by

$$A_a = I(1 - V_{\text{true}}/V_{\text{mkt}}) \quad (5)$$

The subscript 'a' is simply to distinguish this adjustment from others to be encountered below.

(ii) The market declines to fund the project. In this case we have  $V_{\text{mkt}} < I \leq V_{\text{true}}$ , or  $\text{NPV} + A_a < 0$ , and the market's undervaluation of the project means that it can not go ahead. Now the source of the funds has made a difference to a real investment decision: had the entrepreneur possessed a sufficient proportion of the amount  $I$ , the project would have been undertaken. A question which arises is how to represent this possible outcome ex ante in the DCF setting.

*Incorporating the search for finance.* We suggest that the costly process of providing information and searching be viewed as an intrinsic part of the project, to be included in the DCF valuation. This assumes that the entrepreneur is able to fund at least the search process. An entrepreneur with a project typically approaches the capital market by contacting one or two suppliers of venture capital, usually with the help of a financial adviser. On being turned down by one capitalist, the entrepreneur can approach another, but continuing the process will be costly in time and fees. There will come a time when further search will not be worthwhile, assuming that each rejection reduces the estimated probability of acceptance next time. If the entrepreneur abandons the project without paying for the provision of better information or a longer search, the implication is that s/he judges the further expense not to be worthwhile. In other words, the expected cost of alleviating the information asymmetry, or of finding a supplier of funds, exceeds the NPV of the project in the absence of this cost.

The above process suggests the following timeline and DCF representation.

Timeline

$t_0$	$t_1$
Search for funds	Project in progress (if undertaken) →

At date  $t_0$  the entrepreneur estimates the gain from the project as at date  $t_1$  and estimates the cost of information provision and search for external finance. The time between  $t_0$  and  $t_1$  is uncertain ex ante and must also be estimated. As at  $t_0$  it is not certain what the entrepreneur will receive or possibly pay at  $t_1$ . The expected payoff at  $t_1$  as at  $t_0$ ,  $E(Y_{t1})$ , is given by

$$E(Y_{t1}) = \sum_s \pi_s [(1 - I/V_{\text{mkt},s})V_{\text{true}} - S_s] \quad (6)$$

$$\text{subject to } \min(1 - I/V_{\text{mkt},s}) = 0$$

where  $s$  is a contingent state at date  $t_1$ ,  $\pi_s$  is the probability of that state and  $S_s$  is the cost of search (assumed to be incurred at date  $t_1$ ).  $E(Y_{t1})$  is the expected value of possible estimates of the gain to the entrepreneur, across states in which the market-estimated NPV at  $t_1$  is non-negative, net of the expected cost of search.<sup>8</sup> The NPV of the project at  $t_0$ , including the expected cost of search and the possibility of failing to raise capital after searching, is the present value of  $E(Y_{t1})$ . It is worth seeking funds if  $E(Y_{t1}) \geq 0$ : the expected value of positive payoffs exceeds the expected cost of search. If the project is funded, then the position as at date  $t_1$  is

$$\text{Gain to entrepreneur} = \text{NPV} + A_a - S = (1 - I/V_{\text{mkt}})V_{\text{true}} - S \quad (7)$$

This could turn out ex post to be negative; the gain to the entrepreneur for his or her holding in the project could be less than the cost of the search for funds.

### ***Parent company with a project: Stein (1996)***

We now turn to cases in which a potential project is developed by an existing company. The first is the setting of Stein (1996), who assumes that a firm is assessing a new project that is identical to the existing firm, and is to be funded from retained cash. Share issues and repurchases are ruled out for the moment. Managers know the true expected cash

flow of the parent-project combination, and investors make a forecast of the cash flow which is incorrect, so that the firm and the project are both either overvalued or undervalued. The expected return on the firm's equity at market value is less (more) than the true expected return if the firm is over (under) valued. This means that the project's discount rate inferred from the market price is below (above) the true discount rate. Stein argues that the managers should use the discount rate inferred from the market price to value the project and decide whether to accept it, if their aim is to maximise value in the short term, before investors correct their cash flow forecast. Managers should use the true discount rate if their aim is to maximise long term value.

However, it is potentially misleading to argue that the incorrect valuation of the parent and its clone project affects the project's cost of equity. The market's misvaluation is a circumstance which is independent of the project, and which can vary over time and from firm to firm. Allowing for the misvaluation by adjusting the cost of equity changes the project's NPV. But we are assuming the existence of a project which has a (full-information) positive NPV that is independent of the market's valuation. The managers must therefore know the true cost of equity, which is different from the expected return on the parent's misvalued shares. The cost of equity can be estimated in theory via the certainty-equivalent version of the CAPM without knowledge of the project's market value. It is clearer conceptually for the effect of the misvaluation to be treated as an up-front adjustment to shareholder value that is independent of the project's true NPV, rather than as an adjustment to the cost of capital. The adjustment to value can be described in a DCF appraisal as a temporary gain or loss due to market misvaluation, which is relevant for the appraisal because of the assumed aim of managers to maximise short term value. The adjustment  $A_{\text{temp}}$  for the project is given simply by

$$A_{\text{temp}} = V_{\text{mkt}} - V_{\text{true}} \quad (8)$$

The values are for the project rather than the parent-project combination.

We now allow for share issues and repurchases. If the managers believe the shares to be misvalued, they have an incentive to make either a share issue if the price is too high or a repurchase if the price is too low. This is so whether or not the firm has a new project in hand. The benefit of the company's market-timing transaction in its own shares can be thought of as a windfall gain which is made if the firm issues shares at a price above the full-information price, or repurchases shares at a price below the full-information price, whichever applies. The gain accrues to the shareholders who do not buy the new shares in an issue or sell their shares in a repurchase, assuming that they still retain their shares at the time in the future when the firm becomes correctly valued. Stein shows that misvaluation of the shares does not affect the company's hurdle rate for projects, assuming that the managers are seeking to maximise long term value, that debt can be issued or repaid at a fair price and that there is no optimum leverage. However, when losses from deviating from an optimum leverage are introduced, he argues that the market's misvaluation does affect the project's hurdle rate, even if the managers are seeking to maximise long term value. For example, if the firm is undervalued, the managers will wish to repurchase shares, but they will reduce or forgo the repurchase if the loss in value from becoming overleveraged exceeds the gain from repurchase. In the extreme case in which the firm's optimum leverage is zero and the agency/distress costs of any debt are very high, the only source of cash for repurchases is retained cash flow. Then the cost of equity for a project can be viewed as being more than the opportunity cost were it a stand-alone project, allowing for the forgone gain from using the cash to repurchase the parent's undervalued shares. The case is similar if the firm has no cash and issues undervalued shares to fund the project: the existing shareholders lose some of the gain they would have received when the shares become correctly valued.



It would be clearer, again, to capture this effect by including an up-front adjustment to the value rather than by altering the project's cost of equity. The project has, by assumption, a known cost of equity. The fact that there will be a forgone gain to shareholders if the project is funded is a circumstance which does not affect the project's true value. The situation is transparent if there is an adjustment  $A_b$  to the project's value for the parent company in question that captures the forgone gain:

$$A_b = -I(TV_{\text{true}} - TV_{\text{mkt}})/TV_{\text{mkt}} \quad (9)$$

where  $TV$  stands for the total value of the parent-project combination.  $(TV_{\text{true}} - TV_{\text{mkt}})/TV_{\text{mkt}}$  is the percentage gain to shareholders when the share becomes correctly valued, per dollar of current market value, assuming that the value of the company at the repurchase or issue price is  $TV_{\text{mkt}}$ .  $I$  is the amount invested in the project. So  $-A_b$  is the value which would be gained by the shareholders remaining after a repurchase of shares of amount  $I$ , or alternatively the value saved by not issuing undervalued shares to the amount  $I$ .

***Parent company with a project: Myers and Majluf (1984)***

The assumptions in Myers and Majluf are slightly different. The project need not be a clone of the parent and, more importantly, investors are assumed to be rational, which means that pure market-timing gains via a share issue or repurchase are ruled out, for the following reason. Consider a firm about which there is information symmetry, without a new project. The argument is that such a firm can not issue shares at a price above a certain minimum price which is agreed by all to be the lowest value possible for the firm, because willingness to issue at a higher price implies that the shares are overvalued. However, the presence of a new project with positive NPV opens up the possibility of a share issue at a price that is above the minimum, at which existing shareholders do not lose out.<sup>9</sup> Managers act in the interests of existing shareholders, so any project contemplated has non-negative NPV. New shares worth

the cost  $I$  of undertaking the project are issued to new investors only. There are three possible outcomes in the Myers-Majluf model for a parent with a project.

(i)  $V_{\text{old}} + I \geq a + V_{\text{true}}$ , where  $V_{\text{old}}$  is the market value of the old shares when the new shares are issued and  $a$  is the true value of the existing assets.  $V_{\text{true}}$  is the true value of the project, as before. In this case the new shares are issued at a price at least as high as their true value, and the project goes ahead. The loss for the new shareholders as a result of buying the issue at a price equal to or higher than the true value is  $I[(a + V_{\text{true}})/(V_{\text{old}} + I) - 1]$ . The term in square brackets is the percentage change in the market value of the equity between the time just after the issue and the later time when the market value becomes equal to the true value. This is multiplied by  $I$ , the cash invested by the new shareholders. Their loss is the old shareholders' gain. The total gain for the old shareholders is  $I[1 - (a + V_{\text{true}})/(V_{\text{old}} + I)] + (V_{\text{true}} - I)$ . The new term,  $(V_{\text{true}} - I)$ , is the NPV of the project. The true value of the old shares is given by  $[V_{\text{old}}/(V_{\text{old}} + I)](a + V_{\text{true}})$ , so the NPV all goes to the old shareholders so long as  $V_{\text{old}}$  at the time of issue is at least as high as  $a + V_{\text{true}} - I$ , as is being assumed.

(ii)  $V_{\text{old}} + I < a + V_{\text{true}}$ , but  $I[1 - (a + V_{\text{true}})/(V_{\text{old}} + I)] + (V_{\text{true}} - I) \geq 0$ : the new shares are issued at a price below their true value, but the project still goes ahead.  $I[1 - (a + V_{\text{true}})/(V_{\text{old}} + I)]$  is now negative and represents the loss to the old shareholders as a result of making the issue at a price below the true value. But the old shareholders still gain so long as their share of the project's NPV is at least as much as the value transferred to the new shareholders.

(iii)  $I[1 - (a + V_{\text{true}})/(V_{\text{old}} + I)] + (V_{\text{true}} - I) < 0$ : the old shareholders would lose as a result of the issue, so neither issue nor project go ahead.

Which one of these outcomes will arise depends on the (true) values of  $a$ ,  $V_{\text{true}}$  and  $I$ , and on the probability distribution of  $a + V_{\text{true}}$  as the market perceives it at the time of issue.

They determine what  $V_{old}$  will be if there is, or is not, an issue. The true values are assumed to be discovered by the managers at the time they decide whether to issue, but not by investors.

In the Myers-Majluf analysis a share issue, if there is one, is always the result of the arrival of a project, because market-timing issues are ruled out. Some of the gain or loss caused by misvaluation at the time of issue is due to the market's misvaluation of the existing firm rather than the new project. But since any gain or loss due to misvaluation of the existing firm is only ever realised if the firm has a new project (and issues equity to finance it), it seems appropriate to attribute all the gain or loss to the project in the DCF valuation. The suggested way to incorporate the gain or loss is via an up-front adjustment to the present value, given by

$$A_c = I[1 - (a + V_{true})/(V_{old} + I)] \quad (10)$$

If  $V_{true} - I + A_c < 0$ , the cost of the misvaluation to the old shareholders exceeds the NPV of the project. Implicitly, the cost of trying to correct the misvaluation also exceeds the NPV of the project.

### ***Credit rationing***

Credit rationing constitutes another outcome in which information asymmetry causes good projects requiring external funds not to be undertaken. Bolton and Dewatripont (2005, pp. 57-62) present the following case, based on Stiglitz and Weiss (1981, Section I). Credit rationing exists when some of a group of identical projects obtain loans while the remainder do not, and each project's equity would have a positive NPV given the promised interest rate. There are two types of project with the same expected return; 'safe' projects that will make a small future payment with high probability, and 'risky' projects that will make a large future payment with low probability. There is one risk-neutral bank. The assumed nature of the

information asymmetry is especially severe: the bank can get no project-specific information at all ex ante, and so it can not distinguish between the risks of projects.

The assumed response is that the bank offers a single promised interest rate on all its loans. Given this, it may be optimal for the bank to set the promised rate sufficiently low that owners of the safe type will apply for a loan but will be indifferent as to whether they obtain one. The owners of both types of project will apply for a loan, and a proportion of both types will be turned down, assuming that the bank's supply of loanable funds is less than the demand. The owners of the risky type face credit rationing if turned down, since their NPV is positive at the interest rate set by the bank and they would be willing to pay a higher promised rate. The owners of the safe type who are turned down are not counted as rationed, since they would have been left with zero NPV if accepted. No safe projects will apply for funds if the bank demands any higher interest rate, because their NPV would then be negative. Demanding a higher rate will result in a lower profit for the bank if the demand for funds from risky projects is sufficiently small in relation to the potential demand from safe projects.

Credit rationing would disappear if the bank could charge applicants promised rates that were contingent on the performance of the project. However, this ignores problems of incomplete contracting and agency: it may not be possible, or may not be worthwhile, to operate a contract in which the payment to the bank is contingent on performance.

The assumption that the bank charges the same promised interest rate on all its loans has the effect that the riskier borrowers may be charged too little; the expected return on a loan to a risky borrower at the fixed promised rate may be less than the required minimum expected return. We can also imagine a case in which an owner would be willing to pay a promised rate which is too high (the expected return on the loan would exceed the required minimum), in order not to lose the remaining positive NPV. Let us use the term 'full-information promised rate' for the promised rate at which the true expected return on the

amount lent is equal to the required minimum expected return in a competitive loan market with full information.

Interest payments are cash payments, so one way of incorporating a promised interest rate which is too high or low in the DCF model is to subtract contingent interest and principal payments from contingent cash flows. The resulting expected cash flows net of interest and net of corporation tax would then be discounted by the cost of equity, not the WACC, appropriate for the cash flows. However, the convention in capital budgeting is that the cash flows discounted are net of corporation tax but gross of interest, and so the value of a project is given by the market value of the equity and debt, not the value of the equity alone. In this case the presence of debt with a promised rate that differs from the full-information promised rate affects the division of NPV between equity and debt. The impact on the division can be shown as an up-front adjustment to the present values of the debt and equity, given by the difference between the true present value of the contingent payments to the lender under a debt contract  $C$ ,  $V_{\text{debt},C}$ , and the cash amount lent  $D_C$ :

$$A_{\text{debt},C} = V_{\text{debt},C} - D_C \quad (11)$$

where  $A_{\text{debt},C}$  is the adjustment to debt value under contract  $C$ . The adjustment to equity value is equal to  $-A_{\text{debt},C}$ . If the full-information promised rate had been charged on the amount lent,  $A_{\text{debt},C}$  would be zero.

Credit rationing requires that the promised rate be set below the full-information promised rate, and that loans are denied to some good projects. The possibility that the project is turned down can be represented ex ante in a similar way to the case discussed above of a stand-alone project which may not be able to obtain outside equity. The expected gain in wealth from the project for the owner at  $t_1$  as at  $t_0$ ,  $E(\Delta V_{t1})$ , is given by

$$E(\Delta V_{t1}) = \sum_s \pi_s [V_{\text{true}} - I - A_{\text{debt},C,s} - S] \quad (12)$$

subject to  $\Delta V_{t1} = -S$  if  $D_{C,s} = 0$  or if  $V_{\text{true}} - I - A_{\text{debt},C,s} < 0$

where  $S$  here is the cost of approaching the bank, assumed to be known. The project will not go ahead either if it is turned down by the bank ( $D_{C,s} = 0$ ) or if there would be a loss to the owner.

## **2.6 Agency problems and debt contracts**

This final section considers models in which the agency problem that managers will pursue their own interests is assumed to be so severe that external capital can be raised in the form of debt only. External equity is taken to be too problematic or expensive.

### ***Managers covet cash flows***

We consider first a model presented in Hart (1995, pp. 101-17) in which a project is funded by debt and the following assumptions are made. (i) Managers covet the project's cash flows, which are given, and (ii) the financier is unable to obtain any payment from the managers, except via costly liquidation of the project or part of it, or by threatening to liquidate. (ii) can be a result of information asymmetry; the financier does not observe the cash flow outcome or project value at a given date without liquidating the project. In this case the function of liquidation is to discover the value (costly state verification) as well as to obtain payment. Alternatively, it can be assumed that the financier observes the cash flows and project value, but can not force the managers to pay out any cash except via the mechanism of liquidation. The assumptions imply that the managers will retain all the cash flows for themselves, unless it is in their interests to pay out some cash in order to avoid liquidation, or unless the project is actually liquidated.

Projects produce cash flows at two future dates and can be liquidated or part-liquidated at the first date only; at the second date the project is worth nothing aside from the cash flow it produces and there is no way to extract any of the cash from the managers. The

cash flows and liquidation value are certain at date 0 for a given project. If it is assumed that the managers will always succeed in bargaining down the cash paid out at date 1 to (just above) the liquidation value, they can not credibly pledge any of the date 1 cash flow in excess of the liquidation value. As a result of these circumstances the cash flows for the lender will be less than the total expected cash flows from the project, even if the lender has provided all the capital.

Resort to external debt will cause value to be lost for some projects, for either of two reasons. First, the liquidation value at date 1 may be less than the external funds required, in which case the project concerned will not go ahead. Second, some of a given project may have to be liquidated at date 1 to secure a large enough payment for the financier at date 1, given the funds  $I$  required at date 0; and liquidation is assumed to destroy value.

It could be argued that the contract would be ‘improved’ ex ante if there were a syndicate of lenders rather than one. The argument is that it would be harder for the managers to bargain down the total payment to the lenders at date 1 to the liquidation value. The hard budget constraint resulting from the presence of several lenders enables more funds to be lent at date 0, reducing the proportion of projects that will not go ahead. We might think of a contract with several lenders as one with improved technology. But the nature of the possible improvements depends on the assumptions made. For example, in some contracting models the contract is improved if it can be re-negotiated ex post, in which case it is better to have one lender only as this facilitates re-negotiation.

The effects of a debt contract on a given project’s DCF valuation can be set out as follows. The maximum value for the project,  $V_{\max}$ , arises if the managers can fund the project entirely. The managers keep the cash flows  $Y_1$  and  $Y_2$ , and there is no loss of value due to contracting problems:

$$V_{\max} = Y_1 + Y_2 \tag{13}$$

The discount rate is assumed to be zero for simplicity, as in Hart.

The value of the project funded under a given loan contract  $C$  is  $V_C \leq V_{\max}$ :

$$V_C = Y_1 + p_L L + (1 - p_L) Y_2 \quad (14)$$

where  $L$  is the liquidation value and  $p_L$  is the proportion of the project liquidated;  $p_L > 0$  if  $Y_1 < D_1$ , where  $D_1$  is the amount due to the lender at date 1. The loss in value, if any, due to having to obtain external funds under contract  $C$  is  $V_C - V_{\max}$ , caused by the possibility of inefficient partial liquidation in the model outlined. The cost of inefficient liquidation will appear in the cash flows. For some projects there will be a payoff from liquidation and then a reduced or zero payoff at date 2, and liquidation is inefficient because  $L < Y_2$ . The amount the lender will provide under contract  $C$ , and the market value of the contract assuming equilibrium in the capital market, is  $V_{\text{debt},C} \leq V_C$ :

$$V_{\text{debt},C} = D_1 \quad (15)$$

subject to  $D_1 \leq L$

The amount  $V_C - V_{\text{debt},C}$  is the project value captured by the managers, ie the present value of the cash flows not paid out to the lender.

If  $V_{\text{debt},C}$  is less than the external capital required, the project does not proceed: the cost of obtaining external finance is too high. The problem is not that the opportunity cost of external capital is too high. The problems are that the project provides more cash than it is possible to secure under the terms of the contract and that it is, by assumption, too expensive to change this; the cost of improving contract  $C$  exceeds the benefit.

### ***Managers covet power***

We now allow the managers' utility from a project to depend on aspects other than or in addition to the contingent cash flows they receive. The project provides its managers with 'private benefits' that do not just depend on the cash flows. The key implication is that, if the



managers were able to fund the project in full, so that they had complete control of it at all times, they would manage it in a way which does *not* maximise its present value. So the project's cash flows are determined in part by the incentives and constraints under which the managers operate, and hence by the contracts under which funds are provided.

Managers can be assumed to care about various private benefits. A prominent supposition is that their utility is positively related to the size of the company, with the result that they invest in some projects with negative NPV and keep projects going beyond the time at which their continuation ceases to add value. In a setting of this type, financing arrangements can potentially constrain the value-destroying behaviour of managers, resulting in higher project value compared with the value if the managers had free rein. This is the hypothesised benefit from the use of debt and dividends to reduce free cash flow in a business. The 'internal capital markets' found within multi-divisional groups can also be modelled as systems intended to limit the misallocation of capital which arises from a desire for excessive growth on the part of divisional managers.

To show how debt can constrain excessive growth, we consider another of the models in Hart (1995, pp. 129-36). There are two future dates and the cash flows as at date 0 are uncertain. The uncertainty is resolved at date 1. Further investment at date 1 is not possible but if the managers were able to fund the project themselves, they would always keep it going to date 2, even if liquidation at date 1 would yield more cash. Funding the project entirely by external equity would not prevent the managers from doing this. The shareholders would receive all the cash flows - the managers are assumed to covet power, not cash - but the managers would not make the decisions that maximised present value. The most that could be raised at the outset by selling equity is the present value of the non-value-maximising cash flows.

Consider now a debt contract under which fixed repayments  $D_1$  and  $D_2$  are required at dates 1 and 2 respectively, with liquidation of the project in the event of default at date 1. If it turns out at date 1 that  $Y_1 < D_1$ , the managers can borrow more, but only up to  $Y_2 - D_2$ . So if  $Y_1 < D_1$  and  $Y_1 + Y_2 < D_1 + D_2$ , the project will be liquidated, providing cash of  $L$ . Liquidation prevents wasteful continuation of the project if  $Y_2 < L$ ; it increases the cash flows to financiers and indeed the cash flows from the project. But liquidation destroys value if  $Y_2 > L$ ; in this case it would be efficient to renegotiate  $D_1 + D_2$  down to  $Y_1 + Y_2$ , but it is assumed to be too costly to do this. Depending on the probability distributions of  $Y_1$ ,  $Y_2$  and  $L$  as at date 0, it may be possible to set  $D_1$  and  $D_2$  so that more can be raised under the debt contract than could be raised via equity. This will be the case if the role of liquidation in preventing wasteful continuation is sufficiently valuable ex ante. Thus, the circumstances of whether the project is financed by debt or equity, and the terms of the debt contract (the values of  $D_1$  and  $D_2$ ), affect the project's cash flows, its present value and the amount that can be raised via external finance.

The effects of the contract imply the following in the DCF model. We again start with a project, something that produces a set of contingent cash flows when combined with a financing arrangement. The effect of the financing is in the cash flows. The maximum value if the project were run to maximise wealth,  $V_{\max}$ , is

$$V_{\max} = \sum_{s \neq s_L} \pi_s (Y_{1,s} + Y_{2,s}) + \sum_{s=s_L} \pi_s (Y_{1,s} + L_s) \quad (16)$$

where  $s_L$  is a state in which the project is liquidated and in this value-maximising case  $s = s_L$  if  $Y_{2,s} < L_s$ . The maximum value may be notional, in that it will not be the market value if the project is always controlled by the managers, and it may not be attainable under any feasible financing arrangement. The value of the project if financed by the managers,  $V_{\text{mgr}}$ , is

$$V_{\text{mgr}} = \sum_s \pi_s (Y_{1,s} + Y_{2,s}) \quad (17)$$

which is less than the  $V_{\max}$ .

The value of the project funded under a given loan contract  $C$  is  $V_C \leq V_{\max}$ :

$$V_C = \sum_{s \neq s_L} \pi_s (Y_{1,s} + Y_{2,s}) + \sum_{s=s_L} \pi_s L_s \quad (18)$$

where now  $s = s_L$  if  $Y_{1,s} < D_1$  and  $Y_{1,s} + Y_{2,s} < D_1 + D_2$ . The impact of the contract on project value is given by  $V_{\text{mgr}} - V_C$ , and this could be positive or negative, as we have seen. In this case the market value of contract  $C$  is equal to the value of the project under contract  $C$ , because of the assumption that the managers do not retain any of the cash flows.

The assumption that utility is not merely a function of cash flows raises the fundamental question of whether the project should be managed to maximise its present value. Under standard assumptions, maximisation of value ensures maximisation of utility because it is assumed (i) that lifetime utility derives from contingent consumption alone and (ii) that the market for contingent claims is complete.<sup>10</sup> Allowing managers to derive private benefits from their projects means that (i) does not hold, and the policy which maximises market value can differ from the policy which maximises total utility from the project. The optimum decisions might be viewed as those which maximise the total utility from the cash flows and private benefits, not the decisions which maximise the market value.

Table 1 around here

### 3. Conclusion

The academic literature contains a number of hypotheses about what the effects of financing on value might be. Table 1 shows the way in which each of the effects we have considered should appear in the DCF model, according to our discussion. A given effect can appear either in the project's contingent cash flows, or in its cost of capital, or via an up-front adjustment to the present value. We have taken the view that the cost of capital should be as close to an opportunity cost as possible, given the normal definition of WACC. The result is

that the effects captured in the cost of capital are limited to the tax saving from debt, the applicable personal tax rates and the effect of disclosure on the liquidity of the shares and the estimation risk. The costs of financial distress, transactions costs of raising capital, and the effects of financing on agency costs are captured in the cash flows. The effect of misvaluation of a parent and project by the capital market is accommodated by an adjustment to present value.

Further questions related to the paper are how to estimate the impact of financing and parentage effects on value, what the sizes of the impacts are and what determines these sizes. Several recent papers measure the impact of certain effects via various types of simulation, for example Childs et al (2005), Graham (2000) and Parrino and Weisbach (1999). There is less research on how a company might in practice go about estimating the change in its market value were it to change some aspect of its financing, or on how to estimate the financing-related difference in value of a project across two possible parent companies. It is hoped that the current paper has at least made clearer what the implications are for DCF valuation of a broad swathe of financing effects.

**Table 1**  
**Summary of ways of incorporating financing effects in the DCF model**

Financing effect	Project cash flows <sup>1</sup>	Effect incorporated via	
		Cost of capital	Up-front value adjustment <sup>2</sup>
Trade-off theory:			
Tax advantage to debt		•	
Personal tax		•	
Costs of financial distress	•		
Dividend payout:			
Tax disadvantage to payout		•	
Non-tax net benefits	•		
Disclosure:			
Lower cost of capital		•	
Costs of disclosure	•		
Transactions costs of raising capital	•		
Gain or loss due to information asymmetry:			
Stand-alone project before search for funds			•
Stand-alone project after search for funds			•
Project with parent			•
Promised interest rate differs from full-information promised rate <sup>3</sup>			•
Agency costs:			
Managers covet cash flows	•		
Managers covet power	•		

<sup>1</sup> Including adjustments to up-front cash cost.

<sup>2</sup> Not a cash flow.

<sup>3</sup> Adjustment to value of debt.

## **Acknowledgements**

I am grateful to Ian Hirst and two anonymous referees for their comments on the paper.

## **Notes**

1. The tax advantage of debt appears as a separate cash flow stream under the adjusted present value approach of Myers (1974), and is valued using an explicit discount rate. However, the risk of the stream of tax savings is in general hard to specify, since the tax savings are the difference between the taxes paid by the unlevered and the levered project, and these tax streams have different risks. See Fernandez (2004) for the valuation of tax savings for perpetuities and Armitage (2005, ch. 7) for a review of WACC and leverage, including the cases of risky debt and projects with finite lives.

2. An exception is Fernandez (2002), who suggests capturing the larger expected cost from higher leverage by using either of two simplified formulae for the relation between the beta of the levered equity and leverage. The simplified formulae specify a greater sensitivity of the equity beta to leverage than does the correct formula assuming risky debt. This approach is pragmatic but ad hoc, and it does not allow for variation across projects in the relation between the expected costs of distress and leverage. Fernandez (p. 389) notes that, alternatively, the costs of leverage can be viewed as a reduction in the expected cash flow. In the context of a perpetuity, he derives the percentage by which the expected cash flow is reduced that is implied by each of the simplified formulae for a given percentage increase in leverage.

3. Equivalently, it is not yet a set of contingent cash flows and the state or stochastic discount factors are not fully determined. In the absence of taxes and costs of trading assets, the state discount factors are exogenous to any individual asset, so that differences in the cost of capital across assets are determined solely by differences in the distribution of each asset's cash

flows across the contingent states. If we allow taxes and costs of trading to affect an asset's cost of capital, we have to allow them to affect the state discount factors, in which case the latter will depend partly on features of the asset in question.

4. Another way in which parentage affects value via leverage is analysed by Parrino and Weisbach (1999). They study the effect of the parent's leverage on the value to the parent's shareholders of a project financed by equity. The effect is caused by the shareholder-debtholder conflict of interest. There is a gain or loss in the value of the debt, depending on the volatility of the project's cash flows in relation to the volatility of the parent's cash flows. The change in the debt value changes the project's value to the parent's shareholders. The authors show via simulations that the size of the change is positively related to the correlation between parent and project cash flows.

5. Some countries operate imputation tax systems which reduce or eliminate the tax disadvantage. Also, under the 'new view' analysis of the impact of dividend taxation, the rate of income tax on dividends makes no difference to the cost of equity if the marginal source of equity is retained earnings. But the cost of equity is higher if the source of the capital is a share issue rather than retained earnings, which means that the cost of equity for a given project will depend on whether the parent can finance the project from retained earnings or has to issue shares. So this is another situation in which parentage matters. Under the standard 'old view' treatment of dividends, the cost of equity is the same for retained earnings and a share issue. Armitage (2005, ch. 8) compares the old and new views.

6. It is conceivable that a project will be large and different enough compared with the parent that it changes the parent's payout policy. In this case there will in theory be a knock-on effect, attributable to the project, on the value of the parent's existing business.

7. WACC in equation (1) is not a pure opportunity cost because it is gross of some taxes and also gross of trading costs. For WACC to be closer to a pure opportunity cost,  $R_E$  and  $R_D$

would be after personal tax, there would be no  $(1 - T_C)$  adjustment, and the cash flows to discount would be measured as  $(Y_t - \omega_t T_C)(1 - T_P)$ , where  $\omega_t$  is the profit *net* of interest for date  $t$  (ignoring lags in tax payments) and  $T_P$  is the effective personal tax rate, ie the proportion of the cash flow net of corporation tax which is paid in personal taxes.  $T_P$  would be very difficult to measure in practice, which is one reason why WACC is always expressed before personal tax.

8. Equation (6) assumes that the entrepreneur only sells enough of the shares to raise  $I$ . If  $V_{\text{mkt}} > V_{\text{true}}$ , the entrepreneur might wish to sell all the shares, in which case

$$E(Y_{t1}) = \sum_s \pi_s [V_{\text{mkt},s} - I - S_s \text{ for states in which } V_{\text{mkt},s} > V_{\text{true}}] + \\ \sum_s \pi_s [(1 - I/V_{\text{mkt},s})V_{\text{true}} - S_s \text{ for states in which } V_{\text{true}} \geq V_{\text{mkt},s} \geq I]$$

9. But if borrowing is allowed, the firm can not issue equity, because it would imply that the equity was overvalued. An undervalued firm would always borrow rather than issue shares, unless financial distress is introduced.

10. Market completeness means that claims to cash payoffs or consumption units in every contingent state can be traded at date 0. If the market for contingent claims is not complete, the managers may choose to retain and manage the project in the way which provides contingent non-tradable payoffs that result in maximisation of their utility, though not in maximisation of the project's market value.



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