Richard Fairchild (UK)

Managerial overconfidence, moral hazard problems, and excessive life-cycle debt sensitivity

Abstract

The effects of managerial overconfidence on financing decisions and firm value are analyzed, given that investors face managerial moral hazard. Two cases are considered. In the first case, the manager may have an incentive to exert an inefficiently low level of effort in running the business ('managerial shirking'). The manager may issue high debt as a commitment device (the increase in expected financial distress drives him to a higher effort level). An overconfident manager overestimates his ability, and underestimates financial distress costs. Therefore, the first model predicts a positive relationship between overconfidence and debt. However, the effect of overconfidence on firm value is ambiguous, and depends on which factor (the positive effect of higher effort, or the negative effect of higher debt and higher expected financial distress) dominates. In the second case, the manager has an incentive to use free cash flow to invest in a new pet project that may be value-reducing (the free cash flow problem). In contrast to the first case, overconfidence may result in a *decrease* in debt (the rational manager knows that the new project is value-reducing and uses high debt to commit not to invest in it, while the overconfident manager perceives the new project as value-increasing, and reduces debt in order to make the investment). Again, the effect of overconfidence on firm value is ambiguous, since a project that may have been value-reducing under a rational manager may indeed be value-increasing under an overconfident manager, as the overconfident manager exerts higher effort. The analysis is concluded with a conceptual model of "*excessive life-cycle debt sensitivity due to managerial overconfidence*" not previously explored in the literature.

Keywords: behavioural corporate finance, overconfidence, moral hazard, life-cycle debt.
JEL Classification: G32.

Introduction

Since the seminal work of Modigliani and Miller (1958), much research effort has been directed at understanding firms' capital structure and investment decisions, and the corresponding effects on firm value. Until recently, the standard approach was to assume rationality of managers and investors. For example, a large body of research exists examining the role of security signalling in the face of informational asymmetries in a rational framework (e.g., Leland and Pyle, 1977; Ross, 1977; Myers and Majluf, 1984). Another strand of research examines the use of capital structure to mitigate agency problems (Jensen and Meckling, 1976; Grossman and Hart, 1982; Jensen, 1986; Dewatripont and Tirole, 1991; Fairchild, 2003). This approach assumes a principal-agent problem based on selfish managerial rationality.

Increasingly, researchers are recognizing that managerial biases may affect corporate finance decisions. Particularly, research efforts have focused on the effects of managerial overconfidence on managers' financing and investment decisions[1].

This paper focuses on the combined effects of managerial overconfidence and moral hazard on capital structure decisions (note that asymmetric information and signalling problems are not considered). The next subsection reviews the research into rational capital structure decisions in the face of moral hazard followed by the section which considers the existing research in managerial overconfidence and capital structure.

Rational capital structure decisions in the face of moral hazard. The seminal work on rational capital structure decisions in the face of agency problems/moral hazard was undertaken by Jensen and Meckling (1976). They considered a model in which a self-interested manager could divert company funds for consumption of value-reducing private benefits. Increasing the debt level (and reducing outside equity) aligned the manager with the investors by increasing the manager's personal equity stake in the firm, hence reducing his incentives to take private benefits.

Jensen (1986) considered self-interested managers' incentives to waste free cash flow on empire-building, value-reducing, projects. Increasing debt commits managers to paying out to debt holders, hence reducing the free cash flow problem.

Grossman and Hart (1982), Dewatripont and Tirole (1991), and Fairchild (2003) recognized the disciplining role of debt. In the Grossman and Hart model, the manager can divert cash flows for investment in private benefits, while in the two latter

[1] See, for example, Statman and Caldwell (1987), Kahnemann and Lovallo (1993), Stein (1996), Shefrin (1999), Goel and Thakor(2000), Malmendier et al. (2005a, 2005b, 2005c), Heaton (2002), Gervais et al. (2003), Hackbarth (2002, 2004a, 2004b), Oliver (2005), Ben-David et al. (2006), de C. Barros and Di Micela da Silveira (2007), Fairchild (2004, 2005a, 2005b), Zacharakis and Shepherd (2001). For a comprehensive review of the literature in this area, see Baker et al. (2004).

models, managers do not like exerting effort, and so have an incentive to 'slack'. If debt holders are not paid, they can force the firm into bankruptcy. This provides an incentive for managers to increase effort level, increasing firm value. An interesting implication of these models is that managers may voluntarily wish to issue high levels of debt in order to commit to higher effort levels and high firm value. This is because, in an efficient capital market in which rational investors pay a fair price for their investments, existing equity holders, including management, gain all of the positive net present value from an investment.

Managerial overconfidence and capital structure decisions. Increasingly, researchers are recognizing that the bias of overconfidence may play a significant role in managers' financing and investment decisions (see footnote 1). Heaton (2002) cites the psychological research (e.g., Weinstein, 1980; March and Shapira, 1987) that supports the view that people are over-optimistic or overconfident. This research demonstrates that agents tend to be more optimistic about outcomes a) that they believe they can control, and b) to which they are highly committed. Both findings support the view that managers may be overconfident about the success of their ventures.

Shefrin (1999) in his survey of behavioral finance states that overconfidence may induce a manager to adopt an excessively heavy, sub-optimal, debt-laden capital structure. Heaton (2002) analyzed the effect of overconfidence on financing decisions in the absence of asymmetric information or moral hazard problems. Since the manager is overconfident, he *believes* that the market undervalues his equity. Therefore, the Myers-Majluf mispricing problem exists. That is, the manager may pass up a positive NPV project, in which case, free cash flow is beneficial. However, due to managerial overconfidence, the manager may take negative NPV projects that he mistakenly believes to be positive NPV. Now free cashflow is harmful (as in Jensen, 1986). Hence, Heaton argues that, given managerial overconfidence, an optimal level of free cash flow exists that eliminates both the Myers-Majluf and Jensen problem.

Hackbarth (2002, 2004a, 2004b) develops models to consider the effects of managerial overconfidence on capital structure decisions. Hackbarth (2002) demonstrates that managerial overconfidence results in higher debt levels, which may be beneficial for shareholders. Hackbarth presents two versions of the model. In the first version, the manager attempts to act in the interest of shareholders. His objective is to maximize the perceived value of the firm (trading-off tax benefits versus bankruptcy costs of debt).

Since an overconfident manager perceives debt as more undervalued than equity, he issues higher level of debt than a rational manager. In the second version of Hackbarth's model, the agency problem of free cash flow exists (as in Jensen, 1986). An overconfident manager chooses a higher debt level than a rational manager. This serves to mitigate the free cash flow problem, hence aligning managers' and shareholders' objectives.

Hackbarth (2004a) considers a wider menu of effects of managerial overconfidence. He finds that overconfident managers choose higher debt levels, issue new debt more often, need not follow a pecking order of financing, and tend to time capital structure decisions. Hackbarth (2004b) considers the effect of managerial overconfidence on bondholder/shareholder conflicts. He demonstrates that overconfidence can mitigate underinvestment problems, but can exacerbate risk-shifting problems.

Despite the difficulties of finding observable measures of managerial overconfidence, there have been some recent attempts at empirical analysis of the relationship between managerial overconfidence and capital structure. Malmendier and Tate (2005b, 2005c) proxy managerial overconfidence using managers' stock option exercise decisions. The same authors (2005a, 2005c) analyze press statements to develop an index of managerial overconfidence. Oliver (2005) uses the University of Michigan Consumer Sentiment Index as a measure of overconfidence. Barros and Silveira (2007) employ an entrepreneur/non-entrepreneur classification as a proxy for overconfidence. All of these studies find a positive relationship between overconfidence and debt.

This paper develops a financing model in which managerial overconfidence and agency problems combine to affect the manager's debt decision and firm value. Two cases are considered. In the first case, the manager may have an incentive to exert an inefficiently low level of effort in running the business ('managerial shirking'). The manager may issue high debt as a commitment device (the increase in expected financial distress drives him to a higher effort level). An overconfident manager overestimates his ability, and underestimates financial distress costs. Therefore, the first model predicts a positive relationship between overconfidence and debt. However, the effect of overconfidence on firm value is ambiguous, and depends on which factor (the positive effect of higher effort, or the negative effect of higher debt and higher expected financial distress) dominates. In the second case, the manager has an incentive to use free cash flow to invest in a new pet project that may be value-

reducing (the free cash flow problem). In contrast to the first case, overconfidence may result in a *decrease* in debt (the rational manager knows that the new project is value-reducing and uses high debt to commit not to invest in it, while the overconfident manager perceives the new project as value-increasing, and reduces debt in order to make the investment). Again, the effect of overconfidence on firm value is ambiguous, since a project that may have been value-reducing under a rational manager may indeed be value-increasing under an overconfident manager, as the overconfident manager exerts higher effort.

Hence, the first model supports the existing empirical research that finds a positive relationship between managerial overconfidence and debt. However, the second model derives a novel result, not previously found in the theoretical or empirical research; managerial overconfidence may result in a decrease in debt, as the overconfident manager overestimates future investment opportunities, and hence reduces debt, compared to the rational manager, in order to invest in these new projects. Later in the paper, this novel result is discussed, as well as the implications for future research.

Managerial overconfidence and life-cycle financing. Damodaran (2001) argues that a firm's capital structure decisions are not static and constant, but are dynamic over the life-cycle of the firm. He postulates that the firms' debt level should be low at the early start-up and growth stages, as firms need flexibility for new projects, and the disciplining role of debt is low. When the firm approaches the later mature growth and decline stages, Damodaran (2001) argues that high debt may be optimal. At these latter stages, the firm does not have many good investment opportunities available, and so does not need financial flexibility. Furthermore, managerial moral hazard (for example, effort shirking) may be high, so that the disciplining role of debt becomes important.

Combining the results of the two models suggests a novel result, which may be termed "*excessive life-cycle debt sensitivity due to managerial overconfidence*". The early-stage model shows that, when investment opportunities are available (with some having positive NPV and some having negative NPV), an overconfident manager may choose *lower* debt than a rational manager. The later stage model shows that, when there are few investment opportunities available, and when the disciplining role of debt becomes important, an overconfident manager may choose *higher* debt than a rational manager. Hence, life-cycle debt may be sensitive to managerial overconfidence. This is discussed further in section 3.

The rest of the paper is organized as follows. Section 1 presents the later stage 'managerial shirking' model, and demonstrates a positive relationship between overconfidence and debt. In section 2, the early stage 'free cash flow' model is developed. This demonstrates a *negative* relationship between overconfidence and debt. Section 3 provides a discussion of the empirical implications of the model, and conceptualises the "excessive life-cycle debt sensitivity due to managerial overconfidence" model. The last section concludes.

1. A 'later-stage' financing model of managerial overconfidence and shirking

The first model considers moral hazard relating to managerial shirking, and the manager's use of debt to commit to higher effort. In terms of the life-cycle, the first model may be considered as a 'later stage' in the life-cycle. The firm does not have any future investment opportunities, and debt can be considered as addressing moral hazard relating to existing projects and current performance.

Consider a firm, run by a self-interested manager. The manager may be fully rational ('well calibrated'), or he may be overconfident regarding his ability.

The timeline of the game is as follows.

Date 0 (*Financing stage*): The firm makes its debt decision. It may issue one of three possible debt levels; $d \in \{D_L = 0, D_M = D > 0, D_H = 2D\}$, representing low (zero) debt, medium debt, or high debt, respectively. Debt is repayable at date 2.

In addition, the firm has an existing asset in place $A > 2D$ at date 0. The asset in place grows in value between date 2 and date 3, such that it becomes $A(1+g)$ at date 3 if debt-holders are paid at date 2, and $(A-d)(1+g)$ at date 3 if debt-holders are not paid at date 2. The rationale behind this is that if the debt-holders are not paid at date 2, they seize assets to obtain their payoff. This disrupts the firm's future growth. This may be thought of as financial distress.

The financial market observes the manager's debt decision, and values the firm accordingly. The manager receives a proportion $\alpha \in [0,1]$ of the date 0 market value of the firm.

Date 1 (*Effort stage*): The manager chooses an effort level e. He faces a cost of effort βe^2.

Date 2 (*Project outcome/ Debt repayment stage*): The project succeeds with probability $p = \gamma e$, and fails with probability $1 - p = 1 - \gamma e$. The manager perceives the success probability as $\hat{p} = \hat{\gamma} e$, where $\hat{\gamma} \geq \gamma$ measures the level of overconfidence. If the

project succeeds, it provides income $R > D_H = 2D$ and debt-holders are repaid, regardless of the level of debt chosen at date 0. If the project fails, it provides income zero, and debt holders are not paid. Therefore, they seize assets $A - d$.

Date 3 (*Asset growth stage*): Assets in place grow to $A(1 + g)$ or $(A - d)(1 + g)$, as described earlier.

The date 0 value of the firm is $V = p[R + A(1 + g)] + (1 - p)[(A - d)(1 + g)]$, where the first term represents the probability of success multiplied by firm value in the case of success, consisting of the project income R plus the terminal value of the asset-in-place $A(1 + g)$. The second term represents the probability of failure, multiplied by the firm value in the case of failure (that is, zero income from the project, plus the terminal value of the assets, $(A - d)(1 + g)$, given that debt-holders have seized assets to cover the debt.

The date 0 value of the firm can be re-written as;

$$V = p[R + d(1 + g)] + (A - d)(1 + g). \qquad (1)$$

The manager's perceived payoff is

$$\hat{\Pi}_M = \alpha V - (1 - \hat{p})Fd - \beta e^2. \qquad (2)$$

The first term is the manager's share of the date 0 value of the firm. The second term is his expected personal financial distress costs. F is a parameter reflecting the level of personal financial distress the manager experiences if the firm fails. This could represent actual monetary losses from running a bankrupt firm. It could represent reputation losses (effectively, the manager may never run another company, since it is known that he has already run a bankrupt company). In this case, the personal financial distress costs would be the present value of all future income foregone. Finally, F could represent behavioral costs such as guilt.

Note that F is multiplied by d; the higher the level of debt, the higher the manager's personal financial distress costs from putting the firm into bankruptcy.

Further, note that the second term of the payoff incorporates the overconfident manager's *perceived* probability of failure $(1 - \hat{p})$.

The game is solved by backward induction.

Date 1: The manager's choice of effort.

First, take as given the manager's date 0 debt choice d and the date 0 market valuation V and consider the manager's optimal date 2 effort choice. The manager chooses his effort level to maximize his expected payoff; equation (2). Note that, since the

manager has already received his date 0 monetary payoff αV when making his date 1 effort decision, his optimal effort choice is purely driven by his desire to reduce the expected financial distress costs.

Substituting for $\hat{p} = \hat{\gamma}e$ into (2), and solving $\frac{\partial \hat{\Pi}_M}{\partial e} = 0$, the manager's optimal effort level is derived as follows:

$$e^* = \frac{\hat{\gamma}Fd}{2\beta}. \qquad (3)$$

Note that the manager's optimal effort level is increasing in overconfidence, in expected financial distress, and in the debt level. It is decreasing in the cost of effort parameter.

Substituting (3) into (2), the manager's indirect payoff is obtained as follows:

$$\hat{\Pi}_M = \alpha V - Fd + \frac{\hat{\gamma}^2 F^2 d^2}{4\beta}. \qquad (4)$$

Note that, since $\hat{p} = \hat{\gamma}e = \frac{\hat{\gamma}^2 Fd}{2\beta} \in [0,1]$, (4) is decreasing in d for a given aV. However, the manager is using the debt level as a commitment to effort, which affects aV. Therefore, now move back to date 0 to solve for the optimal debt level.

Date 0: Manager's choice of debt level.

Now move back to date 0 in order to determine the manager's optimal debt choice. It is assumed that investors are fully rational, and correctly anticipate the effect of the manager's date 0 choice of debt on his date 2 effort level, as given by equation (3). Therefore, the manager's date 0 choice of debt level determines date 0 market valuation V. The manager knows that the market assesses the success probability as $p = \gamma e$ (the overconfident manager believes that the market under-assesses his ability), which is substituted into equation (2). Therefore, the manager's payoff becomes;

$$\hat{\Pi}_M = \frac{\gamma \hat{\gamma}Fd}{2\beta}[R + d(1 + g)] + (A - d)(1 + g) -$$
$$- Fd + \frac{\hat{\gamma}^2 F^2 d^2}{4\beta}. \qquad (5)$$

The manager's payoff from the respective debt choices $d \in \{0, D, 2D\}$ is

$$\hat{\Pi}_M = A(1 + g). \qquad (6)$$

$$\hat{\Pi}_M = \frac{\gamma\hat{\gamma}FD}{2\beta}[R + D(1+g)] + (A-D)(1+g) -$$

$$-FD + \frac{\hat{\gamma}^2F^2D^2}{4\beta}. \qquad (7)$$

$$\hat{\Pi}_M = \frac{2\gamma\hat{\gamma}FD}{2\beta}[R + 2D(1+g)] + (A-2D)(1+g) -$$

$$-2FD + \frac{4\hat{\gamma}^2F^2D^2}{4\beta}. \qquad (8)$$

Assume that (8) > (7) and (8) > (6) for the overconfident manager, and (7) > (8) and (7) > (6) for the rational manager, for whom $\hat{\gamma} = \gamma$. Therefore, the rational manager optimally chooses the medium debt level $d = D$, and the overconfident manager chooses high debt $d = 2D$.

Therefore, the result of the first model is as follows:

Proposition 1: The rational manager's chooses medium debt level $d = D$, and the overconfident manager chooses high debt $d = 2D$. Firm value is positively related to debt (and overconfidence) if

$$\frac{2\gamma\hat{\gamma}FD}{2\beta}[R + 2D(1+g)] + (A-2D)(1+g) - 2FD >$$

$$\frac{\gamma^2FD}{2\beta}[R + D(1+g)] + (A-D)(1+g) - FD.$$

Otherwise, firm value is negatively related to debt (and overconfidence).

Hence, the first model supports the existing research that finds a positive relationship between managerial overconfidence and debt. Intuitively, the overconfident manager overestimates his skill, and therefore overestimates the probability of success. Therefore, he underestimates the probability of financial distress. This induces him to choose high debt level (to commit to high effort in order to increase current market valuation, which boosts his compensation).

Although overconfidence leads to higher debt, and a potentially higher probability of financial distress, the effect on firm value is ambiguous, because, as well as inducing higher debt, overconfidence also induces higher managerial effort.

2. An 'early stage' financing model of managerial overconfidence and free cash flow

The second model considers an early-stage firm that has productive investment opportunities (or projects) available, and has sufficient free cash flow to make these investments. The firm's debt level affects its financial flexibility to make these investments. Investors are risk-neutral, and the risk-free rate is zero.

Consider the following time-line:

Date 0 (*Firm's choice of debt level*): The firm begins with free cash flow $X > 0$. The firm chooses a low, medium or high debt level, respectively $D_L < X - 2I, D_M \in \{X - 2I, X - I\}, D_H > X - I$ (with I to be described next). Debt is repayable at date 1.

Date 1 (*Investment stage*): The firm continues to hold free cash flow $X > 0$. Further, the firm has two new projects (project 1 and project 2) available (the manager and the market were aware of these opportunities at date 0). Each project requires investment I, with $X > 2I$.

If project 1 is taken, it provides a sure cash flow $R > I$ at date 2, and therefore has positive net present value (NPV). The expected outcome of project 2 is affected by managerial effort, as described next.

Furthermore, it is assumed that, if the manager can only take one project, he will take project 1. Therefore, the debt level affects the firm's ability to take the projects as follows. If $D_L < X - 2I$, the firm can take both projects. If $D_M \in \{X - 2I, X - I\}$, the firm can only take project 1. If $D_H > X - I$, the firm cannot take any project.

Date 2 (*Effort stage*): If the manager takes project 2, his effort level e affects the success probability P. Specifically, the project's success probability is given by $P = \gamma e \in [0,1]$, where γ is the manager's ability parameter. The manager faces cost of effort $c = \beta e^2$.

Managerial overconfidence is modelled as follows. The manager's perceived ability is $\hat{\gamma} \geq \gamma$. Therefore, the manager's perceived success probability is $\hat{P} = \hat{\gamma}e$. If $\hat{\gamma} > \gamma$, the manager is overconfident in his ability. If $\hat{\gamma} = \gamma$, the manager is 'well-calibrated' (or rational). If the project succeeds, it provides income R. If it fails, it provides income zero.

Date 3 (*Project outcome stage*): If project 1 has been taken, it provides income $R > I$. If project 2 has been taken, it succeeds, and provides income R, with probability P, and it fails, and provides income zero, with probability $1 - P$.

Since the firm has free cash flow, with productive 'growth' opportunities available, the model may be considered as relating to the early stage of the firm's lifecycle. Following Damodaran's (2001) life-cycle analysis of capital structure, the second model considers the effect of debt on the firm's ability to invest in the new projects.

It is assumed that, if the manager has enough free cash flow (after paying debt holders) to invest in both projects, he will do so. Further, if the manager only has enough free cash flow to invest in one project, he chooses project 1 (the positive NPV project).

Depending on managerial ability and effort, project 2 may have positive or negative NPV. If project 2 has negative NPV, the manager can use the debt level to commit not to take project 2, as follows. If the manager issues debt $D > X - I$, he is unable to take either project. If he issues debt $X - I > D > X - 2I$, he is able to take project 1, but is unable to take project 2. If he issues debt $D \leq X - 2I$, he is able to take both projects.

The analysis proceeds to solve for the manager's optimal date 0 debt level. The manager has an exogenously given equity stake $\alpha \in [0,1]$ in the firm. It is assumed that the manager can only realize his financial wealth in the long term (i.e., he can sell his equity at date 2). At date 0, the market observes the manager's debt choice and values the firm accordingly. The manager obtains all of the positive NPV.

Therefore, if the manager issues low debt $D_L \leq X - 2I$, he is able to take both projects. Therefore, the manager's payoff is

$$\hat{\Pi}_M = \alpha(\hat{V} + R + X - D) - \beta e^2 + \Pi_E + \Pi_D - 2I, \quad (9)$$

where $\hat{V} = \hat{\gamma} e R$ represents the manager's perceived expected valuation of project 2, R represents the expected value of project 1, X is the current free cash flow, D is the face value of debt, βe^2 is the manager's cost of effort, $2I$ is the required investment in the two projects, and Π_E and Π_D are the equity-holders' and debt-holders' respective market valuations.

Solving $\dfrac{\partial \hat{\Pi}_M}{\partial e} = 0$, the manager's optimal effort level becomes $e* = \dfrac{\alpha \hat{\gamma} R}{2\beta}$, which is increasing in overconfidence. Therefore, $\hat{V} = \dfrac{\alpha \hat{\gamma}^2 R^2}{2\beta}$. Substituting into (9), the manager's indirect payoff becomes

$$\hat{\Pi}_M = \frac{\alpha^2 \hat{\gamma}^2 R^2}{4\beta} + (1-\alpha)(\frac{\alpha \hat{\gamma} R^2}{2\beta}) + X + R - 2I. \quad (10)$$

If the manager chooses $X - I > D > X - 2I$, he is only able to take project 1. Therefore, his expected payoff becomes

$$\hat{\Pi}_M = X + R - I. \quad (11)$$

If the manager chooses $D > X - I$, he is unable to take any project, and his expected payoff becomes

$$\hat{\Pi}_M = \alpha X + (1-\alpha)X = X. \quad (12)$$

Since $R > I$, (11) > (12). Therefore, the manager will not issue high debt, $D > X - I$.

The manager makes his choice between medium debt and low debt by comparing (10) and (11). Assume the following;

$$\frac{\alpha^2 \hat{\gamma}^2 R^2}{4\beta} + (1-\alpha)\left(\frac{\alpha \gamma \hat{\gamma} R^2}{2\beta} \right) \geq I >$$

$$\frac{\alpha^2 \gamma^2 R^2}{4\beta} + (1-\alpha)\left(\frac{\alpha \gamma R^2}{2\beta} \right). \quad (A.2)$$

This assumption ensures that, for the overconfident manager, (10) > (11), while, for the rational manager, with $\gamma = \hat{\gamma}$, (11) > (10).

From assumption A.2, the following result is stated:

Proposition 2: Managerial overconfidence affects the debt level and firm value at the early stage (free cash flow and future growth opportunities) model, as follows:

1. The rational manager chooses the medium debt level $X - I > D_M > X - 2I$ (to commit not to take project 2). Firm value is $V = X + R - I$.

2. The overconfident manager chooses the low debt level $D \leq X - 2I$ (in order to be able to take both projects). Firm value is $V = \dfrac{\alpha \gamma \hat{\gamma} R^2}{2\beta} + X + R - 2I$. Firm value is higher in the overconfidence case if $\dfrac{\alpha \gamma \hat{\gamma} R^2}{2\beta} > I$. Firm value is lower if $\dfrac{\alpha \gamma \hat{\gamma} R^2}{2\beta} < I$.

Therefore, the second model provides a novel result: increasing managerial overconfidence results in *lower* debt. This result contradicts existing research that finds a positive relationship between overconfidence and debt. This is discussed further in the next section.

3. Empirical implications

In version 1 of the model (managerial shirking), increasing overconfidence results in higher debt. The value of the firm may increase or decrease. Much existing empirical research provides evidence of a positive relationship between managerial over-

confidence and debt. There have been few empirical tests on the effects of overconfidence on firm value.

In version 2 of the model (free cash flow), increasing overconfidence results in *lower* debt. This is a novel result, not supported by the existing empirical evidence. Following Jensen (1986), the analysis suggests that a negative relationship might exist between managerial overconfidence and debt levels in young firms that face many growth opportunities. In older firms with very few growth opportunities, the standard positive relationship between overconfidence and debt may be expected[1].

Both versions of the model reveal an ambiguous relationship between overconfidence and firm value. There has been little empirical analysis of such a relationship. It is suggested that future researchers could use the event study methodology to analyze the effects of changes in overconfidence on debt levels and firm value/investor returns.

The model also suggests a novel implication, not previously identified in the research; that is, "excess life-cycle debt sensitivity due to managerial overconfidence". Following Jensen (1986), Damodaran (2001) suggests that firms should employ a life-cycle approach to choosing debt levels. He argues that when firms are young (at the early stage of their lifecycle), they should employ low debt levels, in order to provide sufficient cash flow to take new projects. When firms are older (at the latter stage of the life-cycle), future growth opportunities may be low. Furthermore, moral hazard problems in relation to current projects may be high (e.g., managerial shirking). Therefore, Damodaran argues that older firms should have higher debt. In summary, the author suggests that debt should begin at a low level, and increase over the life-cycle of the firm.

The models presented in this paper provide an interesting insight. In the first model, the rational manager chooses medium debt (low enough to take the positive NPV project, but high enough to commit not to take the negative NPV project). The overconfident manager overestimates his ability, and sets low debt in order to take both projects. In the second model, the firm already has a project in place, and has no future opportunities. The rational manager continues to choose the medium debt level, in order to commit to medium effort. The overconfident manager chooses the high debt level, in order to commit to high effort.

Combining these two models, a type of life-cycle model is obtained. It is demonstrated that the rational manager chooses medium debt throughout, while the overconfident manager chooses low debt at the early stage, and high debt at the late stage. Hence, the model predicts that overconfidence will result in excessive sensitivity of debt to the lifecycle. This conceptual analysis is presented in appendix diagram 1.

A further interesting complication is that overconfidence may increase over time and experience (and hence over the lifecycle). Therefore, the sensitivity of debt to the lifecycle may increase over time. This may be tested by regressing debt against a term embodying an interaction of firm age with a measure of overconfidence.

Conclusion

In order to consider the effects of managerial overconfidence on financing decisions and firm value, two moral hazard models were developed. The first model considered the specific agency problem of managerial shirking. The analysis demonstrated a positive relationship between managerial overconfidence and debt, in line with the existing theoretical and empirical research. The second model analyzed an agency problem relating to free cash flow. It provided the novel result that managerial overconfidence and debt may be *negatively* related. In both cases, the effect of overconfidence on firm value was ambiguous.

The model provides a basis for future research. Firstly, the model should be developed into a fully-fledged life-cycle model, integrating the two approaches (managerial shirking and free cash flow) that have been presented here. Secondly, further empirical research is required, analyzing the relationship between overconfidence and leverage (is it positive or negative?). Thirdly, the analysis opens up a new area of theoretical and empirical enquiry into overconfidence and life-cycle debt.

References

1. Barros, L., and Silveira, A., 2007. "Overconfidence, Managerial Optimism, and the determinants of Capital Structure", Mimeo.
2. Damodaran, A. 2001. Corporate Finance: Theory and Practice, Second Edition. Wiley International Edition.
3. Fairchild, R., 2003a. "Conflicts between Managers and Investors over the Optimal Financial Contract". *International Journal of Business and Economics: Symposium on Principal-agent Models.*

[1] A caveat here is that the psychological research demonstrates that overconfidence increases with age and experience. Young firms may be run by relatively inexperienced, much more calibrated managers. There may be much more overconfidence in older firms with more established and experienced managers.

4. Fairchild, R., 2004. "Behavioral Finance in a Principal-agent model of Capital Budgeting". University of Bath School of Management Working Paper Series.
5. Fairchild, R., 2005a "The Effect of Managerial Overconfidence, Asymmetric Information, and Moral Hazard on Capital Structure Decisions". SSRN.
6. Fairchild, R., 2005b. "Managerial Overconfidence, Moral Hazard, and Financing and Investment Decisions". University of Bath School of Management Working Paper Series.
7. Gervais, S., J.B. Heaton, and T. Odean, 2003. "Overconfidence, Investment Policy, and Executive Stock Options". SSRN working paper.
8. Grossman, S., and O. Hart. 1982. "Corporate Financial Structure and Managerial Incentives", in The Economics of Uncertainty, E. Lippman and J. McCall eds., Chicago University Press.
9. Hackbarth, D., 2002. "Managerial Optimism, Overconfidence, and Capital Structure Decisions". Mimeo.
10. Hackbarth, D., 2004a. "Managerial Traits and Capital Structure Decisions". Mimeo.
11. Hackbarth, D., 2004b. "Determinants of Corporate Borrowing: A Behavioral Perspective". Mimeo.
12. Heaton, J.B., 2002. "Managerial Optimism and Corporate Finance". Financial Management 33-45.
13. Leland, H. and D. Pyle, 1977. "Information Asymmetries, Financial Structure, and Financial Intermediaries", *Journal of Finance* 32, 371-387.
14. Jensen, M. 1986. "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers". AEA Papers and Proceedings 323-329.
15. Jensen, M, and W. Meckling, 1976. "Theory of the Firm: Managerial Behavior, Agency Costs and Capital Structure", Journal of Financial Economics, 3, 305-360.
16. Malmendier, U., and G. Tate, 2005a. "Does Overconfidence Affect Corporate Investment? CEO Overconfidence Mesures Revisited". European Financial Management. Vol 11, No 5, 649 - 659.
17. Malmendier, U., and G. Tate, 2005b. "CEO Overconfidence and Corporate Investment". Journal of Finance 60 (5).
18. Malmendier, U., G. Tate and J. Yan, 2005c. "Corporate Finance Policies with Overconfident Managers". SSRN Working Paper.
19. Myers, S.C. and N.S. Majluf, 1984, "Corporate Financing and Investment Decisions When Firms have Information that Investors do not Have". *Journal of Financial Economics* 13, 187-221.
20. Oliver, B (2005). "The Impact of Management Confidence on Capital Structure". Mimeo.
21. Ross, S.A., 1977. "The Determination of Financial Structure: the Incentive Signalling Approach". *The Bell Journal of Economics* 8, 23-40.
22. Shefrin, H. 1999. "Behavioral Corporate Finance". SSRN Working Paper.
23. Statman, M., and D. Caldwell, 1987. "Applying Behavioral Finance to Capital Budgeting: Project Terminations". Financial Management 1987.
24. Stein, J.C., 1996. "Rational Capital Budgeting in an Irrational World". Journal of Business 69, 4. 429-455.
25. Zacharakis, A., and D. Shepherd, 2001. "The Nature of Information and Overconfidence on Venture Capitalists' Decision Making". *Journal of Business Venturing*.
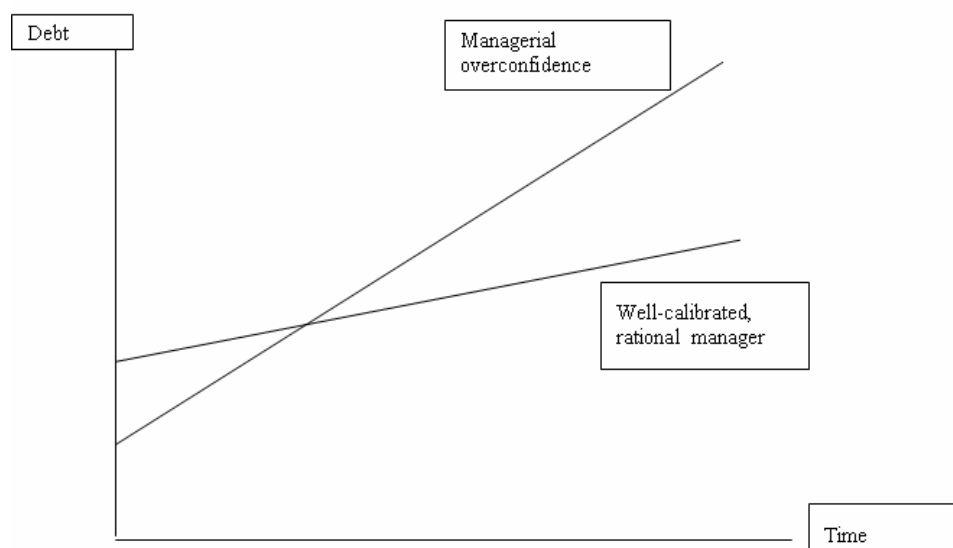
Appendix

Fig. 1. The effect of managerial overconfidence on life-cycle debt

Conceptually, increasing managerial overconfidence may result in an increase in debt sensitivity to the firm's life-cycle (excessively low debt at the early stages, and excessively high debt at the later stages of the life cycle).