Corporate Investment, Financial Policies and Managerial Inconsistent Time Preference

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Abstract

I argue that managerial inconsistent time preference can account for corporate investment and financial decisions. Time-inconsistent, present-biased CEOs are impatient – they have the human tendency to grab immediate rewards and to avoid immediate costs. As a result, present-biased managers procrastinate some good investment projects that incur immediate costs and preproperate borrowing and dividend payout which involve immediate rewards to shareholders. They do so even if they are not myopic (i.e. have long decision horizons) and their incentives are perfectly aligned. I first test this prediction via reduced-form regressions by constructing two proxies for present bias: the CEOs' time preference revealed in their personal portfolio decisions and their press portrayal. I find that firms with present-biased managers significantly invest less, borrow more and pay more dividends. These results are robust to alternative interpretations including myopia, inside information and risk aversion. I then formulate a dynamic investment model in which the value-maximizing top decision maker has inconsistent time preference. Simulation results of the model confirm my present-bias argument: managers cut investments, hold more debt and make more dividend payments if they exhibit self-control problems. These effects destroy firm value by 5.4% to 6.3%.

Keywords: Investment and Financial Policies, Inconsistent Time preference, Managerial Biases
JEL Classification: G30 G32 G35 G41

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1. Introduction

In this paper, I attempt to explore whether managerial self-control problems – modeled as time-inconsistent, present-biased preferences – lead to distortions in firm decisions. In particular, I study the investment, financing and dividend policies of CEOs who have the tendency to grab immediate rewards and to avoid instant costs. I find that time-inconsistent CEOs cut investments, hold more debt and pay more dividends when compared to the time-consistent benchmark.

The standard corporate finance models assume that agents discount payoffs over time exponentially, i.e., they have a constant rate of time preference. However, virtually every experimental study on time preferences suggest that this assumption of time consistency is importantly wrong (Ainslie, 1992; Loewenstein & Prelec, 1992). In fact, most people have self-control problems – they tend to grab immediate rewards and to avoid instant costs (O'Donoghue & Rabin, 1999). For example, when presented a choice between working seven hours on June 1 versus eight hours on June 15, if asked on April 1, nearly all people will choose the seven hours on June 1. But on June 1, given the same choice, most people prefer to delay the work until June 15. In economics, this tendency to give higher weight to the payoff as it gets closer are modeled as time-inconsistent, present-biased preferences (Pollak, 1968; Strotz, 1955).

Building on the extensive experimental evidence on present bias, I argue that one important link between personal characteristics of the CEO and corporate investment and financial strategies is managerial time preference. Different from managerial myopia which stems from the desire to mislead the market by boosting current accounting numbers (Jensen, 1986b; Stein, 1988, 1989), the propensity to grab immediate rewards and to avoid instant costs is a human tendency that could happen even if the manager has a long decision horizon and believes he is maximizing firm value. Time-inconsistent CEOs systematically give extra weight to well-being now over any future moment (Phelps & Pollak, 1968). Higher weight to immediate payoffs can mean that a present-biased manager tends to wait when he should do it if actions involve immediate costs (O'Donoghue & Rabin, 1999). As a result, it is possible for a time-inconsistent CEO to delay some positive net present value (NPV) projects if he perceives it as too costly to invest now, even if it is optimal to do so. When future period arrives, he again procrastinates the value-creating project under the belief that the immediate costs are too high. As a result, if CEOs with self-control problems are not disciplined by corporate governance mechanisms, their bias for the present could lead them to repeatedly delay value-creating investment, resulting in underinvestment relative to the first-best.

Another effect of self-control problems is the tendency to grab immediate rewards when it is optimal to wait. To the extent that borrowing from outside generates instant cash

flows but has delayed interest payments and default costs, managers with present-biased preference tend to borrow more today because they underestimate the benefits of waiting (Meier & Sprenger, 2010). Present-biased CEOs can compound self-control problems by making repeated decisions to preproperate, leading to over-borrowing compared with time-consistent CEOs. Equity issuance, on the other hand, is not preferred by time-inconsistent managers as it involves instant issuance costs. The effect of self-control problems on dividend payment is similar: time-inconsistent executives will pay dividends instead of hoarding cash in cash-rich states, because dividend payment rewards shareholders immediately but interest is taxed. With each decision to preproperate payout, present-biased CEOs increase dividends paid to shareholders each period, resulting in excessive dividend payment in total. Even a small managerial bias for present could lead to sever loss in firm value: with each present-biased decision, the firm incurs a small value loss, but the total is the sum of these increments (O'Donoghue & Rabin, 1999).

To examine the effect of managerial inconsistent time preference on firm investment and financial behavior, I begin by a reduced form regression using a sample of U.S. firms from 2006 to 2016. Two measures of managerial present-biased preferences are constructed. The first one uses CEO's portfolio decision to elicit their attitude towards activities involving immediate rewards. The logic is as follows: CEO receives large grants of options as compensation. Despite that these executive options are non-tradable and managers

cannot hedge the risk of their holdings by short-selling company stock, risk-averse CEOs should exercise options early only if the stock price is sufficiently high (Hall & Murphy, 2002; Lambert, Larcker, & Verrecchia, 1991). If a CEO persistently exercise the option earlier than the threshold suggested by previous literature (Hall & Murphy, 2002; Malmendier & Tate, 2005), I infer that he is impatient to grab immediate rewards. Second, I characterize a CEO as "impatient" or lack of "self-discipline" using hand-collect data on CEO coverage in leading business publications.

My empirical results are as follows. I find that CEOs who are classified as present-biased simultaneously underinvest, hold less cash, have higher leverage levels and pay more dividends. These results are robust to controlling for standard firm financial characteristics, corporate governance, and CEO personal and compensation characteristics. To alleviate the endogeneity concerns of my analysis, I conduct additional tests and show that the effect of present bias on investment and financial decisions are not likely driven by alternative explanations like risk aversion, managerial myopia and negative inside information.

To further explore the effect of managerial inconsistent time preference on firm decisions, I formulate a dynamic structural model of optimal investment, financing and

payout policies for a firm having an equity-maximizing but time-inconsistent manager[1]. The model I consider embeds a broad set of frictions, including corporate and dividend taxation, physical adjustment costs, and linear-quadratic costs of external equity. I analyze the implications of present-biased preference under two assumptions. First, the agents are "naïve" in that they assume that they are acting in a time-consistent manner (Akerlof, 1991). Second, agents are sophisticated in that they correctly foresee their self-control problems (Laibson, 1997). To distinguish present bias from myopia, I also analyze firm investment and financial decisions if the manager has a short decision horizon.

I solve the model numerically and use the solution to generate a panel of simulated data. The simulation result confirms that managerial inconsistent time preference leads to lower investment, more debt holding and higher dividend payment relative to the time-

[1] There are several reasons why a structural model is necessary to examine the effect of managerial inconsistent time preference. First, quantifying the effects of managerial present bias is difficult in part because firms' hiring decisions and investment/financial policies are both endogenous: boards may take self-control into account when selecting a CEO. There is no obvious instrumental variable for the managers' time preference ex-ante at the time when they set the firm policy. I use a backward looking present-bias measure based on CEOs' personal investment and I am able to alleviate some endogeneity concerns by adding control variables that are shown by prior studies to influence managerial myopia. However, it is still difficult to clearly distinguish present bias from myopia in a reduced-form regression as myopia could drive both early option exercise and underinvestment. It is also difficult to absent from all misalignment of interests and information asymmetry problems. Second, people have different beliefs about their future selves' preferences. They could be sophisticated and know exactly how their future selves will behave or they could be naïve and believe they are free of self-control problems. Reduced-form regressions could not distinguish different types of present-bias assumptions. Third, although reduced-form regressions can deliver the directional effects of proxies for present bias on investment and financial decisions, they cannot, by nature, address the extent to which managerial inconsistent time preference influences firm value.

consistent benchmark, resulting in a 5.4% to 6.3% value loss. The extent of these investment and financial distortions depends on whether the time-inconsistent manager is sophisticated or naïve. Specifically, I find that the naïve decision maker invests less than does the sophisticated manager. Because the naïve manager mistakenly believes that he will invest tomorrow, he repeatedly procrastinates some positive NPV projects because of their "high" immediate costs. The sophisticated decision maker, however, correctly anticipates that his future selves will delay some investment. This self-awareness puts pressure on him to enforce self-control and increase investment today. As for financial decisions, sophisticated manager tends to borrow more and pay more dividends than does the naïve manager. This is consistent with the phycology prediction of present bias, as sophistication makes people more tempted to grab today's immediate rewards (O'Donoghue & Rabin, 1999). Naiveté, on the other hand, motivates people to overestimate the benefits of waiting.

When comparing with myopic CEOs, I find that managers exhibiting self-control problems invest in a way that is less sensitive to productivity shocks. This is as expected if myopic CEOs exploit productivity shocks to boost current earnings. Different from present-biased managers who pay dividends instead of holding cash in cash-rich states, I find that myopic managers hold larger amounts of liquid asset. This is as expected if they attempt to exploit opportunities to increase short-term accounting numbers.

In drawing links to the extensive literature on corporate investment and financial decisions and on time-inconsistency I restrict myself here to work that is closest in spirit to my approach. This work is closely related to Riddick and Whited (2009) who analyze the corporate propensity to save in a discrete investment dynamic model in which firms invest, save, raise external finance and make distributions in the face of uncertainty, physical adjustment costs, taxation, and costly equity issuance. I extend their framework by embodying a time inconsistent parameter. I show that when the top decision maker of a firm has self-control problems of making time-inconsistent optimal choices, the firm underinvests, over-borrows and pays more dividends relative to the first-best.

In a related paper, Grenadier and Wang (2007) examine the role of inconsistent time preference in the timing of investment by entrepreneurs in a dynamic real option model. They find that under time-inconsistent preference, investment occurs earlier than in the standard time-consistent framework; and the extent of this rush to invest is lower among naïve entrepreneurs. However, their analysis does not model how the entrepreneur finances the project. When considering financing costs, the decision to investment today may not be preferred by the present-biased decision maker as the immediate costs could be too high. My paper differs from theirs in that my model features simultaneous firm decisions on investment, financing and dividends strategies. After accounting for firm financing and dividend policies, simulation result confirms my argument that present bias induces

managers to invest less compared to the level of investment that would be chosen by a time-consistent manager.

It is important to point out that managerial present-biased preference is not analogical to managerial myopia. In myopia theories, the drive of short-termism is the executive's short horizon (Stein, 1988, 1989). When having a short horizon, managers only pursue projects whose value could be clearly communicated to the market and which generate positive reaction in the short-term. As a result, managers may forsake good investments in an effort to boost current earnings rather than the value of the firm. Different from myopia, managerial inconsistent time preference exists even in managers who have long decision horizons and who act in the interest of long-term firm value. My regression result that present bias has a negative effect on investment is robust to controlling for standard proxies for the tendency of myopia. Simulation result also confirms that present bias is not identical to myopia as they lead to different predictions on firm investment and financial behavior.

The paper contributes to the literature by suggesting a new explanation for suboptimal firm investment and financial behavior. Traditional explanations are the misalignment of managerial and shareholder interests (Jensen, 1986a; Jensen & Meckling, 1976) and asymmetry information between corporate insiders and the capital market (Myers & Majluf, 1984). Recent literature suggests that personal characteristics of the CEO are important for

firm investment and financial decisions (see, e.g. Malmendier and Tate 2005). By highlighting the role of managerial present bias, my results indicate real consequences of managerial inconsistent time preference as it induces CEOs to cut investments, hold more debt, and pay more dividends relative to the first-best.

This self-control based explanation for investment and financing distortions has number of novel policy implications. My findings suggest that a manager whose incentives are perfectly aligned, who has a long decision horizon, and who does not face any information asymmetries may still make suboptimal investment and financial decisions if he lacks enough self-control to make optimal choices in a time-consistent manner. He is not myopic and he believes that he is acting in the best interest of shareholders. As a result, traditional provisions may not suffice to address managerial discretion. Refined corporate governance structures, involving introducing commitment mechanisms to constrain present bias, may be important to achieve first-best investment, debt and dividend levels.

The paper also contributes to the literature by merging two important strands of research: the dynamic corporate finance paradigm and the literature on inconsistent time preferences. Standard firm structural models assume a constant rate of time preference for managers, which is obviously at odds with the prominent stylized fact of inconsistent time preference suggested by psychology and economic studies. Meanwhile, given that the research on dynamic dividend payout is relatively rare, my findings extend the structural

corporate finance literature by demonstrating that time-inconsistency is an important factor influencing payout polices. My research also extends the literature on behavior finance as it generates a flexible framework for recognizing time inconsistency as another behavior bias in firm financial decisions.

The following paper proceeds as follows. In Section 2, I motivate my self-control based story through a reduced-form empirical analysis. In Section 3, I present a structure model for corporate investment and financial policies with a present-biased top decision maker. Section 4 describes the model simulation and its results. Section 5 concludes.

2. Motivating Empirical Analysis

In this section, I introduce my self-control based explanation for suboptimal investment and financial behavior through reduced-form regressions. CEOs exhibiting self-control problems are impatient – they like to experience rewards now but delay costs later. As a result, they procrastinate – wait when they should do it – if actions involve immediate costs (capital investment), and preproperate – do it when they should wait – if actions involve immediate rewards (borrowing, dividend payout). These two manifestations of present-biased preference lead to distortions in firm investment and financial policies. Each period, the overestimation of instant costs makes present-biased managers to forgo some positive NPV projects they perceive to be too costly to invest today.

Meanwhile, at each period, the overestimation of near-term payoffs induces excessive willingness to preproperate borrowing from outside and dividend payments that involve immediate rewards. This bias for the present makes time-inconsistent CEOs to repeatedly delay value-creating investments, and to regularly increase debt holdings and dividend payments over time. These effects may be small for each period, but the incremental effect could be important. As a result, managerial present bias predicts underinvestment, over-borrowing and excessive dividend payout relative to the first-best. I thus obtain the following prediction:

Prediction 1: Present-biased CEOs invest less, borrow more, and pay more dividends, compared with time-consistent CEOs.

2.1 Measuring Present Bias

My first measure of present bias is based on differences across managers in option exercise. Merton (1973) shows that investors should not exercise options early since the right to delay purchasing the underlying stock has non-negative value. Despite that executive options are non-tradable, and CEOs cannot hedge the risk of their holdings by short-selling company stock, risk-averse CEOs should exercise options early only if the stock price is sufficiently high (Hall & Murphy, 2002; Lambert et al., 1991). To put in other words, managers should wait to exercise options when the managerial benefit of continuing to hold the option (option value) exceeds the marginal costs (delayed gains and risk

exposure). Malmendier and Tate (2005) calibrate the threshold for exercise to be 67%, using the Hall and Murphy (2002) model with a constant relative risk aversion (CRRA).

In my sample, I find that 64.61% of CEOs, however, persistently fail to hold lowly in-the-money vested options. One interpretation of this failure to exercise the option later is present bias[2]. CEOs with self-control problems have the tendency to grab immediate rewards. They overestimate the benefits of exercise options early, i.e., the instant gains and relief of risk exposure. As a result, present bias induces excessive willingness to exercise lowly in-the-money option when it is optimal to wait.

Based on these arguments, I construct my first measure for present bias, *Present bias*, as CEOs who, at least twice during their tenure, exercise an option when the option is less than 67% in-the-money. Execucomp does not have option-grant-specific prices, I therefore estimate the average moneyness of vested options following prior literature (Campbell, Gallmeyer, Johnson, Rutherford, & Stanley, 2011; Malmendier, Tate, & Yan, 2011). Specifically, I estimated the total realizable value of the options using Core and Guay (2002) method. The average exercise price is estimated as the difference between the year-end stock price and the realizable value per option. The average moneyness of options is then

[2] Other interpretations for exercising options early include risk aversion, myopia, and negative inside information. After relate present bias to financial decisions, I will discuss the implications of these alternatives on my results.

calculated as the realizable value per option divided by the average exercise price.

My second measure for CEO present bias measures CEO time preference as assessed by outsiders. Specifically, I construct a measure for market perception using press in leading business publications: *The Wall Street Journal*, *The New York Times*, *BusinessWeek*, *Financial Times* and *The Economist*. I retrieve all articles during the sample period that characterize a CEO as (a) "self-discipline" (self-control, self-command, restrain, willpower, strong-mindedness, determination, persistence), and as (b) "impatient" (impatience, eager, eagerness, rush, keen) or negated "self-discipline" terms. For each CEO, I compare for each year, the number of articles that refer to the CEO with (b) "impatient" terms or negated "self-discipline" terms, and (a) the "self-discipline" terms. I then set the present-bias indicator (*press*) at 1 if the total number of articles mentioning "impatient" or negated "self-discipline" terms exceeds the total number of articles mentioning "self-discipline" terms, and 0 otherwise. When using *press* as a measure for the level of present bias, I restrict my sample to CEO-firm-years of which the CEO is at least once mentioned by articles with "impatient", "self-discipline" or negated "self-discipline" terms.

2.2 Data

I start with the Execucomp database for data on CEO compensation and characteristics for the period from 2006 to 2016. Information on directors is obtained from the RiskMetrics database. I supplement the data with accounting items from the Compustat

database, stoke return data from CRSP, and institutional ownership data from the Thomson Financial database on 13f filings. The sample selection procedure is as follows: first, I exclude firms incorporated outside the United State. I then delete any CEO-firm-year observations with missing data, or for which total assets, the gross capital stock, or sales are either zero or negative. A firm is included in the sample only if it has at least two consecutive years of complete data. Finally, I omit regulated, financial and public service firms, of which the primary SIC is between 4900 and 4999, between 6000 and 6999, or greater than 9000. After winsorizing at the 1% and 99% level, I end up with an unbalanced panel of 6,713 firm-year observations.

I also collet data on articles about the CEOs in *The Wall Street Journal*, *The New York Times*, *BusinessWeek*, *Financial Times* and *The Economist.* For each sample period, I record (1) the total number of articles mentioning "impatient" or negated "self-discipline" terms; and (2) the total number of articles with "self-discipline" terms.

Table 1 presents summary statistics of the data. For my two measures for time inconsistent preferences, mean *Present bias* is 0.646, indicating that there is a substantial proportion of CEOs persistently exercise options before their moneyness reaches 67%. The mean of *press* is 0.394, suggesting that of CEOs mentioned by the articles during the sample period, 39.4% are characterized as "impatient" or not "self-discipline" managers.

Table 2 displays the correlations between variables. The correlation of the portfolio-based present-bias measure (*Present bias*) and the press measure (*press*) is positive and statistically significant at the 5% level. For investment and financial policy variables, it is shown that *Investment* is negatively correlated to *Present bias* and *press*, and the correlations are of economic significance. The correlations of *Net cash* and *Cash* to present-bias measures are negative but not significant. *Payout* is positively correlated to *Present bias* and *press.*

2.3 Investment, financial policy, and present bias

In this section, I use the portfolio-based present bias indicator and the press measure to examine the effect of managerial inconsistent time preference on firm investment and financial behavior. The regression specification is as follows:

$$F_{it} = \beta_1 + \beta_2 P_{it} + X'_{it} B_3 + \varepsilon_{it} \quad (1)$$

where F_{it} is the investment and financial variables of interest, and P_{it} is the present-bias measure. I include firm and year fixed effects and cluster standard errors to account for heteroscedasticity and auto-correlation at the firm level.

The investment and financial policy variables I consider are: (1) *Investment*, defined as net capital expenditures scaled by the beginning-of-period assets; (2) *Net cash*, which is the difference between the stock of cash and total long-term debt, scaled by the beginning-

of-period assets; (3) *Cash*, defined as the stock of cash over the beginning-of-period assets; (4) *Debt*, defined as the total debt to the beginning-of-period assets; and (5) *Payout*, defined as total cash distributions scaled by income before extraordinary items.

X_{it} is a set of control variables containing firms' financial conditions, corporate governance, and CEO variables that are shown by prior studies to influence corporate investment and financial policies. The firm-specific financial variables included are firm size, market-to-book ratio and cash flow, which are relevant to the investment opportunities facing the firm and to its internal resources. I use efficient board size (four to 12 members) as a measure of corporate governance, and percentage of shares held by institutional investors as a measure of monitoring from sophisticated investors. At the CEO level, I include CEO stock ownership (as a percentage of total shares outstanding), and total number of vested options (multiplied by 10 and normalized by total number of shares outstanding) to control for the incentive effects of stock and options. These variables are relevant to the tendency of managerial myopia, which leads to reductions in long-run investment (Stein 1988, 1989; Bushee 1998; Edmans, Fang and Wang 2017). Low stock ownership motivates managers to increase accounting earnings rather than the firm value (Jensen, 1986b). Myopia is also related to short-term incentives (Bizjak, Brickley, & Coles, 1993; Stein, 1988, 1989). I thus follow prior literature and include the standard myopia measure *Delta* to capture the managerial incentive to inflate stock price (Hall & Liebman,

1998). *Delta* is the sensitivity of managerial wealth to the stock price stemming from his stock and option compensation. Since both investment and option portfolio are affected by the risk preference of CEOs, I include the sensitivity of the executive's wealth to change in stock volatility (*Vega*) to control for the effect of risk-taking incentives (Coles, Daniel, & Naveen, 2006). Variable definitions are summarized in Appendix A.

Table 3 presents the results of Eq. (1) using the portfolio-based *Present Bias* as a proxy for managerial inconsistent time preference. The first column relates CEO's tendency to expedite option exercise to investment and demonstrates that *Present bias* has a negative coefficient that statistically significant at the 1% level (-0.0176, t-stat = -3.58). Thus, firms of which the CEO is impatient to exercise lowly in-the-money options systematically investment lower. This result is consistent with my self-control story that managers with present-biased preference tend to repeatedly procrastinate some value-creating projects that have immediate costs but delayed benefits, thereby leading to underinvestment relative to the first-best.

In the next three columns, I examine the effect of present bias on leverage policies, including net cash stock, as well as cash and debt holdings. The coefficient on *Present Bias* for *Net Cash* is negative and significant, suggesting that CEOs exhibiting self-control problems tend to hold more debt than cash. Similarly, I find that *Present Bias* has a negative and significant effect on cash holdings, and a significant positive effect on total debt. These

findings are in accordance with Prediction 1 that present-biased CEOs are inclined to preproperate borrowing from outside because it involves immediate rewards but delayed costs. The last column reports the result for dividend payments. I find that firms with present-biased CEOs experience significantly higher dividend payout compared with firms with time-consistent CEOs – the coefficient on *Present bias* is 1.9959 and of statistical significance. This is as expected because holding cash incurs instant interest tax. Among the controls, I find that more cash flow generally leads to more investment, as expected if cash eases financing constraints. Consistent with the myopia story, I find that higher CEO stock ownership is associated with more investment and the coefficient on *Delta* for *Investment* is positive and significant.

Table 4 reports the regression results using the press measure for present bias. Similar to Table 3, I find that the coefficient on *Press* is negative and highly significant, confirming my prediction that managerial bias for the present leads to underinvestment. Consistent with the present-bias story, it is demonstrated that the effect of *Press* on *Debt* holdings is positive and significant, which implies that CEOs who are captured as "impatient" or not "self-discipline" tend to borrow more compared with other CEOs. For *Net cash* and *Cash*, the coefficients on *Press* have predicted sign but are not significant. The result for dividend payments is as expected: dividend payout is significantly higher for firms with CEOs who are assessed by the press as "impatient" or not "self-discipline". Collectively, the results

confirm my Prediction 1 that managerial inconsistent time preference leads to underinvestment, over-borrowing and excessive dividend payout.

2.4 Discussion

The present-bias effect on investment and financial decisions may suffer endogeneity problems since there are many reasons for CEOs to expedite option exercise. These reasons may also influence firm investment and financial behavior. In this section, I discuss alternative reasons for CEOs to exercise options even when rational models suggest to hold, and their relation to firm investment, financing and payout policies.

1. *Past Performance*. CEOs in firms with a recent run-down in stock price may accelerate option exercise to avoid wealth loss. They may also invest less if pool past performance reflects poor investment opportunities facing the firm. Meanwhile, if managerial wealth is highly sensitive to short-term stock price, pool past performance may motivate CEOs to forgo some positive NPV projects so as to inflate current stock price. The CEO may also be reluctant to issue equity and instead rely on debt financing, if pool past performance leads to undervaluation in an inefficient market. To address this possibility, I add five lags of stock returns to the controls in Eq. (1) and continue to find results that are qualitatively similar (not tabulated).

2. *CEO Risk Aversion.* Some CEOs may be more risk-aversion than assumed in the

Malmendier and Tate's (2005) calibration. These CEOs may both preproperate option exercise and underinvest, because it is possible for them to forgo projects with positive NPV but high risk. In Eq. (1), I add *Vega* to control for this investment effect of risk-taking incentives in executive compensations. To further distinguish the effect of present bias on investment and financial strategies from the impact of CEO risk aversion, I include volatility as an additional control. Lower volatility decreases option value and induces early exercise. Lower volatility is also related to increase in leverage, decreased cash holding and more dividend payments (Chen, Wang, & Zhou, 2014). My results are robust to adding volatility as a control (not tabulated).

3. *Managerial Myopia*. In myopia models (Stein, 1988, 1989), managers may fail to invest due to concerns with firm's short-term stock price. Managers may also expedite option exercise if their tenure is short. Previous literature suggest that myopic behavior occurs when managers hold little stock of the company and are compensated in ways that are highly sensitive to the stock price (Jensen 1986). In Eq. (1), I control for the effect of managerial myopia on investment using two control variables: *Stock Ownership* and the sensitivity of managerial wealth to stock price, *Delta*. To further examine whether managerial myopia drives both underinvestment and early exercise, I add *Tenure* as an additional control for CEO short-termism (Antia, Pantzalis, & Park, 2010). I find that *Tenure* has positive impact on investment, but do not affect the estimated effect of early

exercise materially (Panel A, Table 5).

4. *Other CEO Characteristics*. To test whether other CEO characteristics, such as education background, age, and gender, lead to simultaneously underinvestment, over-borrowing, excessive dividend payout and early option exercise, I add financial education indicator, age and gender to the control variables in Eq. (1) . I find that my results are robust (not tabulated).

5. *Inside information*. Negative inside information can simultaneously cause early exercise and underinvestment. To test whether inside information contaminates the portfolio-based measure, I follow Malmendier and Tate (2005) and spilt the sample of CEOs who accelerate option exercise into early exercisers who always profit and early exercisers who at least once lose money. If the negative inside information drives both early exercise and underinvestment, then the portfolio-based present bias measure should only be significant for the "winning" group. Panel B of Table 5 presents the results. As is shown, the coefficients on *Present bias* are significant for both subsamples. Thus, the underinvestment effect of inconsistent time preference is not likely driven by negative inside information[3].

[3] Results are also robust if I decompose my portfolio-based present-bias measure into two dummy variables. The first equals 1 if the CEO persistently exercises options earlier than the 67% threshold and is always better off by exercising the option early and investing in the S&P 500, and 0 otherwise. The second is 1 if the CEO persistently exercises options early and at least once loses money, and 0 otherwise.

3. Model

In this section, I consider a dynamic investment model with financing frictions. The model focus on a representative firm that has a manager whose time preference could deviate from the standard time-consistency assumption. The economic environment facing the firm is described, and followed by a discussion of alternative time preferences. A benchmark case of time-consistent preference is provided to allow for comparisons to the time-inconsistent cases. To distinguish managerial myopia from present-biased tendency, I compare the effect of managerial inconsistent time preference to results assuming a short decision horizon.

3.1 Economic Setup

A risk-neutral firm makes investment and financial decisions in discrete time $t \in \{1, 2, \ldots, T\}$. In any given period, the firm chooses (i) how much to investment; and (ii) how to finance the investment (internal or external funds). Production requires the input of capital stock k , and is subject to a productivity shock z . The profit function $\pi(k, z)$ is continuous, with $\pi(0, z) = 0$, $\pi_z(k, z) > 0$, $\pi_k(k, z) < 0$ and $\lim_{k \to \infty} \pi_k(k, z) = 0$. Concavity of $\pi(k, z)$ results from decreasing return-to-scale technology, a downward sloping demand curve, or both. The shock z has bounded support $[\underline{z}, \overline{z}]$ and follows a first-order Markov process with transition probability $g(z', z)$, where a prime indicates a variable in the next period.

Investment, I is defined as

$$I \equiv k' - (1-d)k \ , \tag{2}$$

in which k' denotes the capital stock of next period and $d \in (0,1)$ is the capital depreciation rate. As in Gomes (2001), I assume that k lies in the interval $\left[0, \bar{k}\right]$, in which $\bar{k}$ is defined as

$$(1-\tau_c)\pi(\bar{k}, \bar{z}) - d\bar{k} = 0 \ . \tag{3}$$

where τ_c is the corporate tax rate. Because $k > \bar{k}$ is not economically profitable, this compactness of the state space and continuity of $\pi(k,z)$ ensure that $\pi(k,z)$ is also bounded.

Capital investment incurs capital adjustment costs that are given by (Cooper & Haltiwanger, 2006)

$$A(k,k') = \lambda_o k \Phi_i + \frac{\lambda_1}{2}\left(\frac{k' - (1-d)k}{k}\right)^2 k \ . \tag{4}$$

The capital adjustment costs encompass both fixed and smooth adjustment costs: the first term, $\lambda_o k \Phi_i$ captures the fixed adjustment costs, in which λ_o is a constant and Φ_i is an indicator that takes the value 1 if investment I is nonzero, and 0 otherwise. The smooth component is described by the second term in which λ_1 is a constant.

As for financing, the firm may borrow, issue new equity or use its internal funds. For the purpose of brevity, I present the model with the stock of net cash p, which is defined

as the difference between the stock of cash, c, and the stock of debt, b. It follows that $p > 0$ indicates cash holdings of the firm while $p < 0$ stands for the level of debt at each time point. The firm may hold cash via a riskless one-period bond that earns a taxable interest at a rate $r^r\left(1-\tau_c\right)$. Debt takes the form of a riskless perpetual bond that incurs taxable interest at the after-corporate tax rate $r^c\left(1-\tau_c\right)$.

Without losing of generality, I follow Riddick and Whited (2009) to assume an arbitrarily high upper bound on liquid assets so as to ensure bounded choice set. The upper bound $\overline{p}$ is set to $\overline{k}/2$. As for debt, I follow the literature on the adverse selection as a mechanism for credit rationing and assume an upper bound for debt, $\overline{b}$. Stiglitz and Weiss (1981), for example, suggest that lenders, recognize the existence of adverse selection and asset substitution problems, may ration on the basis of a screening process that ensures the borrower can repay the loan in all states of the world. This assumption translates to a lower bound of net cash holdings, $\underline{p}$. Following DeAngelo, DeAngelo, and Whited (2011), $\underline{p}$ is defined as $-\overline{p}$.

Equity issuance/distributions decisions are determined simultaneously with investment, debt, and cash. Let $e\left(k, k', p, p', z\right)$ denote the net equity/distributions. A value of $e\left(k, k', p, p', z\right)$ greater than zero indicates distributions to shareholders, and a value less than zero suggests new equity issuance. External equity financing incurs costs, $\phi\left(e\left(k, k', p, p', z\right)\right)$. Since the sources and uses of funds are equal in each period,

$e(k,k',p,p',z)$ can be written as:

$$e(k,k',p,p',z) \equiv (1-\tau_c)\pi(k,z) + p - \frac{p'}{1+r(1-\tau_c)} - \left(k' - (1-d)k\right) - A(k,k') \ , \quad (5)$$

in which r equals r^r if $p' > 0$ and equals r^c if $p' < 0$. Following Hennessy and Whited (2007), $\phi\left(e(k,k',p,p',z)\right)$ is modeled as linear-quadratic and weakly convex:

$$\phi\left(e(k,k',p,p',z)\right) \equiv \Phi_e\left(\phi_0 - \phi_1 e(k,k',p,p',z) + \frac{1}{2}\phi_2 e(k,k',p,p',z)^2\right) \quad (6)$$

$$\phi_i \geq 0, \quad i = 0,1,2$$

in which Φ_e is an indicator that takes the value 1 if $e(k,k',p,p',z) < 0$, and 0 otherwise.

2.2 Dynamic decisions

2.2.1 The time-consistent benchmark

As a benchmark, I briefly consider the case in which payoffs are discounted exponentially. The firm chooses (k', p') to maximize the present value of future cash flows, which is discounted at the exponential discount rate δ. The Bellman equation is

$$V(k,p,z) = \max_{k',b'}\left\{e - \phi(e) - \Phi_d \tau_d e + \delta \int V(k',p',z')\,dg(z',z)\right\} \quad (7)$$

in which τ_d is the tax rate on distributions and Φ_d equals 1 if $e(k,k',p,p',z) > 0$, and 0 otherwise.

The right-hand side of (7) specifies the decision faced by the firm. The first three terms represent the current equity distributions, abstracted from the issuance cost/dividend tax. The last term represents the continuation value of equity. The existence of a unique solution

for (7) is guaranteed by Theorem 9.6 in Stokey and Lucas (1989).

2.2.2 The inconsistent time preference

In my model, I adopt a convenient framework for present-biased preferences which is developed by Phelps and Pollak (1968), and later widely employed by studies like Laibson (1997), and O'Donoghue and Rabin (1999). In particular, they capture the human bias for the "present" over "future" with a two-parameter model in which the discount rate declines as the horizon increases. Formally, let β represent a " a bias for the present" and δ represent long-run, time-consistent discounting. For a decision maker at any time s, the discount function is equal to 1 for $t = s$ and to $\beta\delta^{t-s}$, for $t = s+1, s+2, \ldots$. When $\beta = 1$, the discount function is identical to the time-consistent discounting. However, a β that is smaller than one will generate a bias for the present: the agent gives more relatively weight to period τ in period τ than he did in any period prior to period τ.

Another important question is whether the decision maker is aware of his future selves' preference. Two assumptions are suggested by prior literature (Pollak, 1968; Strotz, 1955): first, the agent could be sophisticated, in the sense that they correctly foresee that future selves act in a dynamically inconsistent manner. Second, the agent is naïve because he falsely believes that his future selves act in the interest of the current self, not realizing that his tastes changes as he gets closer to executing decisions.

The sophisticated decision maker

Consider the case of a sophisticated decision maker who chooses (k', p') each period to maximize the present value of future cash flows. Because of inconsistent time preference, he values the payoffs obtained from the decision made in future stages at only $\beta\delta$ of its future value. Let $W(k, p, z)$ denote the current value function, the current-period Bellman equation is

$$W(k', p', z') = = \max_{k', b'} \left\{ e - \phi(e) - \Phi_d \tau_d e + \beta\delta \int V(k', p', z') dg(z', z) \right\} . \quad (8)$$

As in (7), the first three terms of the right-hand of (8) represents the net equity distributions and $V(k, p, z)$ is the continuation value of equity. The only difference is that besides the exponential discount factor δ, the continuation value of equity is further discounted at the hyperbolical-induced parameter, β.

The problem presented by (8) could be solved by backward induction. Specifically, at the terminal period, the continuation function is the firm's total wealth:

$$V_{T+1}(k_{T+1}, p_{T+1}, z_{T+1}) = \pi(k_{T+1}, p_{T+1}) + k_{T+1} + p_{T+1} . \quad (9)$$

Because the discount factor between any two future period is simply δ, the continuation payoff for other periods, $V(k, p, z)$, are defined recursively as

$$V(k', p', z') = e - \phi(e) - \Phi_d \tau_d e + \delta \int V(k', p', z') dg(z', z) . \quad (10)$$

The naive decision maker

A naïve decision maker fails to realize that he will discount in a present-biased way in future periods. He wrongly believes that, starting from the next period, he will discount by δ between all periods. He will decide today, believing that he will choose from

tomorrow forward by the exponential discount function. Thus, he mistakenly believes that the objective function faced by his future selves is

$$e_k - \phi(e_k) - \Phi_{d,k}\tau_d e_k + \delta \int V(k_{k+1}, b_{k+1}, z_{k+1}) dg(z_{k+1}, z_k), \quad \forall k > t \tag{11};$$

however, when he reaches the next date, he again reoptimizes the objective function with present-biased preference.

2.2.3 Myopic decision maker

In myopia theories (Stein 1988, 1989), the drive of myopic behavior is short planning horizon. To reflect the short-term focus of a myopia planner, I model the myopia discounting function as $\left\{1, \delta, \delta^2, \ldots, \delta^{t'}, (\beta\delta)^{t'+1}, (\beta\delta)^{t'+2}, \ldots\right\}$. Let t' be the last period of myopic planning horizon. The decision maker is patient with payoffs up to t', as he discount payoffs with long-run, time-consistent discounting. The myopic decision is impatient about payoffs that arrives after t'. I assume $t' = 5$ so that it matches the average vesting period of executive options (Edmans, Fang, & Lewellen, 2013; Gopalan, Milbourn, Song, & Thakor, 2014).

For a myopia decision maker, his objective is to maximize

$$\sum_{t=0}^{t'} \delta^t \left(e - \phi(e) - \Phi_d \tau_d e\right) + \sum_{t=t'+1}^{T} (\beta\delta)^t \left(e - \phi(e) - \Phi_d \tau_d e\right) . \tag{12}$$

The first term in (12) represents the present value of payoffs in the short planning horizon, which is discounted exponentially at δ. The second term states the present value of long-run payoffs that are discounted by $\beta\delta$.

Figure 1 graphs the time-consistent discount function (assuming that $\delta = 0.995$), the present-biased discount function (with $\beta = 0.90$ and $\delta = 0.995$), and the myopia discount function (assuming that $\beta = 0.90$, $\delta = 0.995$ and $t' = 5$).

3. Simulation

This section solves the model numerically and compares its implications for different scenarios: (i) the time-consistent benchmark, (ii) the sophisticated time-inconsistent manager who correctly foresees his self-control problems, (iii) the naïve time-inconsistent manager who fails to realize his bias for the present, and (iv) the myopic manager.

3.1 Calibration

For production, the profit function has the form of $\pi(k, z) = zk^{\theta}$ in which $\theta \in (0,1)$ is an index of the curvature of the profit function. I calibrate θ from the estimates of labor shares and make-ups in Rotemberg and Woodford (1992). Assuming a Cobb-Douglas production function and a constant elasticity demand function, their estimates suggest that $\theta \approx 0.75$.

As in Gomes (2001), I parameterize the shock z by using an AR(1) in logs,

$$\ln(z') = \rho \ln(z) + v' \tag{13}$$

in which v' has a truncated normal distribution with mean 0 and variance σ_v^2. I transform (13) into a discrete-state Markov chain using the method in Tauchen (1986), letting $\ln(z)$

have 20 points of support in $\left[-4\sigma_v/\sqrt{1-\rho^2}, 4\sigma_v/\sqrt{1-\rho^2}\right]$. The parameters (ρ, σ_v) are set at the averages of the estimates of these two parameters in Hennessy and Whited (2007): the persistence of the shock, ρ, is set at 0.66 and the dispersion of the shock σ_v is set at 0.121.

For the equity financing cost function, $\phi\big(e(k, k', p, p', z)\big)$, my parameter choices for ϕ_0, ϕ_1, and ϕ_2 are from the estimates of the costs of external equity finance for larger firms in Hennessy and Whited (2007). I set $\phi_0 = 0.389$, $\phi_1 = 0.053$, and $\phi_2 = 0.0002$. I follow Riddick and Whited (2009) to set the interest rate, r^r, equal to 4%, which lies between the values chosen by Hennessy and Whited (2007) and Gomes (2001). Similarly, the cost of capital, r^c, is set at 10%.

I follow Cooper and Haltiwanger (2006) to parameterize the capital adjustment cost function, setting $\lambda_0 = 0.039$ and $\lambda_1 = 0.049$. The depreciation rate is set to equal 15% so that the model matches the average investment to capital ratio found in the data. Corporate tax rate is set at $\tau^c = 0.30$ and dividend tax rate is set to equal $\tau^d = 0.15$.

Finally, the particular parameterization of the discount functions used in my simulations is $\beta = 0.75$ and $\delta = 0.995$. As is pointed by Angeletos, Laibson, Repetto, Tobacman, and Weinberg (2001), these parameter values roughly match experimentally measured discounting patterns. The length of planning horizon for myopia discounting

function, t', is set at 5 so that it matches the average vesting period of executive options (Edmans et al., 2013; Gopalan et al., 2014). Parameters used in the calibration are summarized in Table 6.

In the subsequent model simulation, the state space for capital stock, k, is

$$\left[\bar{k}(1-d)^{40},\ldots,\bar{k}(1-d)^{1/2},\bar{k}\right].$$

I let p have 20 equally spaced points in the interval $\left[-\bar{p},\bar{p}\right]$ in which $\bar{p}$ is set to $\bar{k}/2$.

The model is solved via value function iteration on the Bellman equation using backward inductions in a finite horizon with $T=1000$, which produces the value function $V(k,p,z)$ and the policy function $\{k',p'\}=h(k,p,z)$. In the subsequent model simulation, the space for z is expanded to include 100 points, with interpolation used to find corresponding values of V, k, and p. The model simulation proceeds by taking a random draw from distribution of z' (conditional on z), and then computing $V(k,p,z)$ and $h(k,p,z)$.

3.2 Results

Simulation results are summarized by Figure 2. The first plot is the CEO's decision on capital stock under different productivity shocks. As is expected, I find that compared with the time-consistent benchmark, managers who have a bias for the present always invest lower. Capital investment features immediate costs but delayed benefits. It follows that present-biased managers may repeatedly procrastinate some good investments that

they believe to be too costly to invest now. The total investment thus is lower than the time-consistent benchmark. The extent of this underinvestment depends on whether the time-inconsistent manager correctly foresees his self-control problems. Specifically, I find that when the present-biased manager is not aware of his inconsistent time preference, he invests less than does if he knows he has a bias for the present. Intuitively, knowing how costly delay would be, sophisticates preempt costly procrastination on investment despite their exaggerated aversion to incurring immediate costs (O'Donoghue & Rabin, 1999). Comparing to the investment decision of a manager having a short horizon, time-inconsistent managers invest in a way that is less sensitive to productivity shocks. Since investment when productivity is high generates great return in the short run, myopic decision maker invests more (less) than hyperbolic decision makers when productivity shock is sufficiently high (low).

The second plot describes firm decisions on debt/cash holding. In most situations, a manager with present-biased preference and fully self-awareness tends to borrow more than does the time-consistent manager. Increases in debt holdings reward the company with immediate release of financial constraints but have delayed costs (interest payments and default costs). In this case, present-biased preferences induce sophisticated managers to accelerate debt issuance when it is optimal to wait. Meanwhile, managers with inconsistent time preference will payout dividends instead of hoarding cash because interest is taxed. If

the time-inconsistent manager fails to foresee his inability to commit, the firm holds less debt but more cash compared to the sophisticated, present-biased managers. This is as expected since Naiveté motivates people to overestimate the benefits of waiting. The amount of liquid asset held by myopic decision maker is the highest among all types. This is consistent with the myopic assumption as myopic managers want to hold cash so as to exploit opportunities to increase earnings in short run.

The third plot presents the effect of time-inconsistency on firm equity issuance/net dividend policies. Different from the time-consistent manager who chooses to finance via equity issuance, time-inconsistent managers prefer to pay more dividends to shareholders. Similar to debt issuance, dividend payment has immediate rewards. Despite that equity issuance could ease financing constraints, it also involves instant issuance costs. The dividend payment by a sophisticated time-inconsistent manager is even higher than the naïve present-biased manager, as predicted since sophistication exacerbate the tendency to grab immediate rewards.

The last plot graphs firm value in different scenarios. Simulation results demonstrate that managerial time inconsistent preference could lead to significant value loss: the average value loss is 5.4% for a firm with a sophisticated time-inconsistent manager and is 6.3% for one with a naïve, present-biased manager. Note that a firm is not always better off with a sophisticated time-inconsistent manager than with a naïve, present-biased

manager. In a sense, if one views the time-consistent benchmark as somehow optimal, the sophisticated manager's fully awareness of his self-control problems helps the firm get closer to investment optimality. However, the naïve manager's overestimation of the value of waiting brings the firm closer to optimal financing and dividend levels. Myopic behavior also destroies firm value by 5.6%.

Collectively, simulation results suggest that compared with the time-consistent benchmark, the firm underinvests, over-borrows and pays more dividends if the CEO has sophisticated, present-biased preference; the firm invests less and makes higher dividend payments if the manager has time-inconsistent preference but is not aware of his self-control problems; and the firm holds more cash and invests less if the CEO is myopic.

5. Conclusion

In this paper, I link the managerial time inconsistency to firm investment, financing and dividend policies. My analysis consists of two main steps. First, I construct two measures of present-biased preference based on (1) whether the CEO is impatient to grab immediate rewards when making private portfolio decisions; and (2) how the CEO is assessed by the press. My empirical analysis confirms the time-inconsistency prediction that the tendency to grab immediate rewards and to avoid instant costs induces managers to invest less, borrow more and make more dividend payments. Additional tests suggest

that these effects are not likely driven by alternative explanations like risk aversion, managerial myopia, negative inside information and other CEO characteristics.

Second, I build a dynamic investment model and compare the investment and financial policies when the top decision maker inside a firm (i) has time consistent preference, (ii) is present-biased and has full awareness of his self-control problems, (iii) is time-inconsistent but is not aware of his time inconsistency, and (iv) is myopic. Simulation results are consistent with my time-inconsistency prediction, as the managerial bias for the present leads to underinvestment, over-borrowing and excessive dividend payout compared to the first-best. These effects of time inconsistency have severe real consequences, leading to a 5.4% to 6.3% value loss.

Different from managerial myopia which has been widely-discussed in the literature, my findings suggest a new explanation for suboptimal investment and financial decisions. Building upon a prominent stylized fact from the psychology literature, I argue that managers have the human tendency to put relatively higher weight to payoffs as payoffs come closer. Thus, unlike myopic behavior which is driven by the short decision horizon of executives (Stein, 1988, 1989), managerial inconsistent time preference can exist even with a manager who has a long horizon and behaves in an effort to increase long-term firm value. In fact, my regression results are robust to adding several controls for managerial myopia. Simulation results also demonstrate that managerial present bias influences firm

decisions in a way different from myopia.

The results have implications for contract practice and organization design. Managerial inconsistent time preference provides an alternative interpretation of agency problems in the firm. It suggests that agency costs could arise even when the manager does not face any information asymmetries and believes he is maximizing long-run firm value. As a result, standard incentive contracts are not likely to discipline these present-biased tendencies.

Appendix A Variable Definitions

Variable	Definition
Investment	CAPXV minus SPPE, scaled by the beginning-of-period assets, AT
Net cash	The difference between cash stock and long-term debt (CHE-(DLTT+DLC)), scaled by the beginning-of-period assets, AT
Cash	Stock of cash, CHE, scaled by the beginning-of-period assets, AT
Debt	Total long-term debt (DLTT plus DLC), scaled by the beginning-of-period assets, AT
Payout	Total cash distributions (the sum of DVP, DVC and PRSTKC) over operating income before extraordinary items IB
Present bias	1 if the CEO at least twice during their tenure, exercise an option when the option is less than 67% in-the-money.
Press	1 if the total number of articles mentioning “impatient” or negated “self-discipline” terms exceeds the total number of articles mentioning “self-discipline” terms
Size	The logarithm of total assets, AT
Q	The market value of assets ((CSHO*PRCC_F) + (DLTT+DLC))to the book value of assets, AT
Cash flow	The sum of income before extraordinary items, IB and depreciation DP, divided by the begging-of-period assets, AT.
Efficient board size	1 if the number of directors on board is between four to twelve.
Institutional holdings	The percentage of shares held by institutional investors.
Vested Options	Total number of vested options (multiplied by 10 and normalized by total number of shares outstanding).
Stock Ownership	CEO stock ownership (as a percentage of total shares outstanding).
Delta (M$)	The change in the dollar value of the executive’s wealth for a one percentage point change in stock price.
Vega (M$)	The change in the dollar value of the executive’s wealth for a one percentage point change in annualized standard deviation of stock returns.

TABLE 1 SUMMARY STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
Investment	6,713	0.1015	0.0716	-0.3442	0.4895
Net cash	6,713	-0.0182	0.3142	-1.8312	0.9340
Cash	6,713	0.1808	0.1743	0.0000	0.9340
Debt	6,713	0.1990	0.2078	0.0000	1.9189
Payout	6,713	1.4268	22.7908	-75.9766	93.8356
Present bias	6,713	0.6461	0.4783	0.0000	1.0000
Press	699	0.3944	0.4912	0.0000	1.0000
Size	6,713	7.2670	1.5391	2.8893	11.5630
Q	6,713	1.7158	1.2801	0.2266	15.0879
Cash flow	6,713	0.0885	0.1158	-1.0317	0.8431
Efficient board size	6,713	0.6872	0.3164	0.0000	1.0000
Institutional holdings	6,713	0.7950	0.1961	0.0000	0.9513
Vested Options	6,713	0.0053	0.2632	0.0000	0.0887
Stock Ownership	6,713	0.0015	0.4804	0.0000	0.1067
Delta (M$)	6,713	0.1862	0.3450	0.0002	3.8705
Vega (M$)	6,713	0.0487	0.0809	0.0000	0.9921

Data on executive characteristics and compensation from 2006 to 2016 are from Execucomp. Information on directors is obtained from the RiskMetrics database, accounting items are from Compustat, stock return data come from CRSP and institutional ownership data are from the Thomson Financial database on 13f filings. I exclude firms incorporated outside the U.S. and delete regulated, financial and public firms, of which the primary SIC is between 4900 and 4999, between 6000 and 6999, or greater than 9000. *Present bias* is an indicator for managerial inconsistent time preference based on preferences revealed in CEO's personal portfolio decisions. *Present bias* equals 1 if the CEO, at least twice during his tenure, exercise an option earlier than the 67% threshold. *Press* is an indicator for managerial inconsistent time preference based on how the CEO is assessed by the press, using articles in leading business publications: *The Wall Street Journal*, *The New York Times*, *BusinessWeek*, *Financial Times* and *The Economist*. See Appendix A for variable definitions.

TABLE 2 CORRELATIONS

Variable	Invest-ment	Net cash	Cash	Debt	Payout	Present bias	Press	Size	Q	Cash flow	Efficient Board Size	Inst. Holdings	Vested Options	Stock Ownership	Delta	Vega
Investment	1															
Net cash	0.1593*	1														
Cash	0.1084*	0.7845*	1													
Debt	-0.1500*	-0.8542*	-0.3477*	1												
Payout	-0.0275	-0.0017	0.0004	0.0029	1											
Present bias	-0.2109*	-0.0301	-0.0368	0.0147	0.0269	1										
Press	-0.2115*	-0.0275	-0.0338	0.0132	0.0403	0.5959*	1									
Size	-0.0137	-0.3570*	-0.2408*	0.3378*	0.0192	0.0165	0.0075	1								
Q	0.2783*	0.3620*	0.4013*	-0.2108*	0.0082	-0.3905*	-0.3850*	-0.1923*	1							
Cash flow	0.1691*	0.1174*	0.0467	-0.1384*	-0.0059	-0.2585*	-0.2767*	0.0639*	0.3274*	1						
Efficient board size	-0.0152	0.0556*	0.0569*	-0.0363	-0.0103	-0.0113	0.002	-0.0447	0.0356	0.0152	1					
Institutional holdings	0.1592*	-0.0707*	-0.0494*	0.0654*	0.0384	0.0161	0.0271	0.1235*	-0.0004	0.0828*	-0.0221	1				
Vested options	-0.0042	0.0769*	0.0769*	-0.0518*	-0.0072	-0.1246*	-0.1262*	-0.2268*	0.0632*	0.0418	-0.0131	-0.2575*	1.0000			
Stock ownership	0.0221	0.0975*	0.0920*	-0.0702*	0.0058	-0.0866*	-0.0892*	-0.3188*	0.0681*	0.0237	0.0215	-0.2797*	0.8467*	1		
Delta (M$)	0.0945*	-0.0824*	0.0157	0.1377*	0.0255	-0.1819*	-0.2078*	0.3235*	0.2722*	0.1863*	-0.0386	-0.0121	0.2528*	0.1842*	1	
Vega (M$)	0.0083	-0.0034	0.0539*	0.0504*	0.0814*	0.0931*	0.0786*	0.5079*	0.1180*	0.1140*	-0.0118	0.0481	-0.1143*	-0.1246*	0.4377*	1

This table presents the correlations of variables. * indicates statistical significance at the 5% level.

TABLE 3 REGRESSION OF INVESTMENT AND FINANCIAL DECISIONS ON PORTFOLIO-BASED PRESENT BIAS MEASURE

	Investment	**Net cash**	**Cash**	**Debt**	**Payout**
	I	*p*	*c*	*b*	*d*
Present bias	-0.0176***	-0.0013**	-0.0022*	0.0009***	1.9959**
	(-3.58)	(-2.09)	(-1.94)	(3.09)	(2.01)
Size	0.0036	-0.0568***	-0.0420***	0.0148	3.3139
	(0.48)	(-2.69)	(-2.90)	(1.07)	(1.18)
Q	-0.0057	0.0293***	0.0265***	-0.0029	-0.6785
	(-1.37)	(2.67)	(3.94)	(-0.45)	(-0.55)
Cash Flow	0.0441**	0.1002*	-0.0260	-0.1263***	1.0892
	(2.08)	(1.84)	(-0.59)	(-4.27)	(0.14)
Efficient Board Size	0.0021	0.0125	-0.0098	-0.0223***	0.0087
	(0.51)	(1.24)	(-1.54)	(-2.79)	(0.00)
Institutional Holdings	-0.0041	-0.0350	-0.0396	-0.0046	-1.6836
	(-0.23)	(-0.92)	(-1.47)	(-0.18)	(-0.23)
Vested Options	0.0001	0.0000	-0.0002	-0.0006	-0.0014
	(0.90)	(0.20)	(-0.12)	(-0.49)	(-0.05)
Stock Ownership	0.0001*	-0.0003*	-0.0001	0.0002*	0.0045
	(1.74)	(-1.83)	(-0.97)	(1.80)	(0.17)
Delta	0.0335**	-0.0018	-0.0207	-0.0189*	-0.2980
	(2.27)	(-0.09)	(-1.23)	(-1.75)	(-0.08)
Vega	-0.0012	0.0592	0.0556	-0.0036	25.3043
	(-0.03)	(0.49)	(0.70)	(-0.05)	(1.36)
Constant	0.0762	0.3243**	0.4824***	0.1581	-23.6762
	(1.38)	(2.04)	(4.40)	(1.53)	(-1.13)
Year-fixed effects	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes
Observations	6713	6713	6713	6713	6713
Adj R-squared	0.440	0.332	0.213	0.321	0.313

This table presents the regression result of investment and financial decisions on the portfolio-based present-bias measure. The dependent variables are net capital expenditures scaled by the begging-of-period assets (*Investment*), the difference between total debt and the stock of cash, scaled by the beginning-of-period assets (*Net cash*), the stock of cash over the beginning-of-period assets (*Cash*), the total long-term debt to the beginning-of-period assets (*Debt*), and total cash distributions scaled by income before extraordinary items (*Payout*). *Present bias* is an indicator for managerial inconsistent time preference based on preferences revealed by CEO's personal portfolio decisions. *Present bias* equals 1 if the CEO, at least twice during his tenure, exercise an option earlier than the 67% threshold. Control variables are as described in the appendix. Standard errors are clustered at firm level. T-statistics are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

TABLE 4 PRESS PORTRAYAL AND FINANCIAL DECISIONS

	Investment *I*	**Net Cash** *p*	**Cash** *c*	**Debt** *b*	**Payout** *d*
Press	-0.0098***	-0.0009	-0.0016	0.0004**	0.9762***
	(-2.97)	(-0.08)	(-0.19)	(2.08)	(3.18)
Size	0.0049	-0.0592***	-0.0380***	0.0799	2.3981
	(0.56)	(-2.89)	(-3.24)	(0.09)	(1.01)
Q	-0.0084	0.0189**	0.0172***	-0.0145	-0.2001
	(-1.23)	(2.13)	(4.44)	(-0.34)	(-0.12)
Cash Flow	0.0423**	0.0739	-0.0153	-0.0521**	0.5793*
	(2.09)	(1.56)	(-0.19)	(-2.29)	(1.67)
Efficient Board Size	0.0026	-0.0004	-0.0070*	-0.0187**	-0.2991
	(1.35)	(-1.01)	(-1.94)	(-2.09)	(-0.25)
Institutional Holdings	-0.0031	-0.0189	-0.0226	-0.0109	-1.0223
	(-1.34)	(-0.49)	(-1.01)	(-0.93)	(-0.07)
Vested Options	0.0001	0.0000	-0.0000	-0.0001	-0.0025
	(1.23)	(0.33)	(-0.21)	(-0.22)	(-0.12)
Stock Ownership	0.0000*	-0.0002**	-0.0000	0.0001*	0.0043
	(1.96)	(-1.96)	(-0.67)	(1.69)	(0.29)
Delta	0.0533**	-0.0008	-0.0102	-0.0278**	-0.0534
	(2.48)	(-0.19)	(-0.39)	(-2.08)	(-0.08)
Vega	-0.0045	0.0497	0.0098	-0.0013	21.1986
	(-0.92)	(0.87)	(0.26)	(-1.26)	(1.52)
Constant	0.1224*	0.4806	0.5714***	0.1615	-30.2087
	(1.76)	(1.48)	(3.98)	(0.23)	(-0.98)
Year-fixed effects	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes
Observations	699	699	699	699	699
Adj R-squared	0.329	0.228	0.210	0.221	0.190

This table presents the regression result of investment and financial decisions on the press-based present-bias measure. The dependent variables are net capital expenditures scaled by the begging-of-period assets (*Investment*), the difference between total debt and the stock of cash, scaled by the beginning-of-period assets (*Net cash*), the stock of cash over the beginning-of-period assets (*Cash*), the total long-term debt to the beginning-of-period assets (*Debt*), and total cash distributions scaled by income before extraordinary items (*Payout*). *Press* is an indicator for managerial inconsistent time preference based on how the CEO is assessed by the press, using articles in leading business publications: *The Wall Street Journal*, *The New York Times*, *BusinessWeek*, *Financial Times* and *The Economist*. Control variables are as described in the appendix. Standard errors are clustered at firm level. T-statistics are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

TABLE 5 ALTERNATIVE EXPLANATIONS

Panel A. CEO tenure as an additional control for managerial myopia					
	Investment	Net Cash	Cash	Debt	Payout
	I	*p*	*c*	*b*	*d*
Present Bias	-0.0143***	-0.0015**	-0.0023**	0.0007**	1.8729**
	(-3.24)	(-2.12)	(-2.36)	(2.11)	(2.03)
Stock Ownership	0.0001**	-0.0002*	-0.0001	0.0002*	0.0060
	(2.07)	(-1.86)	(-0.99)	(1.84)	(0.23)
Delta	0.0356**	-0.0017	-0.0207	-0.0190*	-0.2867
	(2.55)	(-0.08)	(-1.23)	(-1.72)	(-0.14)
Tenure	0.0077**	0.0041	-0.0018	-0.0059	0.3082
	(2.11)	(0.21)	(0.12)	(-0.50)	(1.11)
Other control variables	yes	yes	yes	yes	yes
Year-fixed effects	yes	yes	yes	yes	yes
Firm-fixed effects	yes	yes	yes	yes	yes
Observations	6,713	6,713	6,713	6,713	6,713
Adj R-squared	0.445	0.336	0.213	0.321	0.313

Panel B. Negative Inside information		
	Early exercisers who always profit	**Early exercisers who lose money**
	Investment	Investment
	I	*I*
Present Bias	-0.0193***	-0.0166**
	(2.96)	(2.55)
Other control variables	yes	yes
Year-fixed effects	yes	yes
Firm-fixed effects	yes	yes
Observations	1,879	2,458
Adj R-squared	0.443	0.416

Panel A presents the result of a robust test using CEO tenure as an additional control for managerial myopia. CEO tenure is measured as the logarithm of the total number of years a specific individual had held the chief executive officer position within a company. Dependent variables, *Present bias* and other control variables are as described in the appendix. Panel B presents the sub-sample regression results using Eq. (1). I split the sample of CEOs who accelerate option exercise into early exercisers who always profit and early exercisers who at least once lose money. Standard errors are robust to heteroscedasticity and arbitrary within-firm serial correlation. T-statistics are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

TABLE 6 CALIBRATION PARAMETERS

Parameter	Benchmark Value	Empirical Restriction
Production		
θ	0.75	Curvature of the profit function
ρ	0.66	Persistence of the shock
σ_v	0.121	Standard deviation of the shock
Flotation Costs		
ϕ_0	0.389	Fixed Flotation Costs
ϕ_1	0.053	Unit Flotation Costs
ϕ_2	0.0002	Convex Flotation Costs
Capital Adjustment Costs		
λ_0	0.039	Fixed costs of adjustment
λ_1	0.049	Smoothed costs of adjustment
Discount Functions		
δ	0.995	Exponential discount rate
β	0.75	Hyperbolic-induced discount rate
t'	5	Length of planning horizon for myopia decision makers
Others		
r^r	0.04	Risk-free interest rate
r^c	0.10	Cost of capital
τ^c	0.30	Corporate tax rate
τ^d	0.15	Dividend tax rate
d	0.15	Depreciation rate

Note: This table summarizes parameters used in the Calibration.

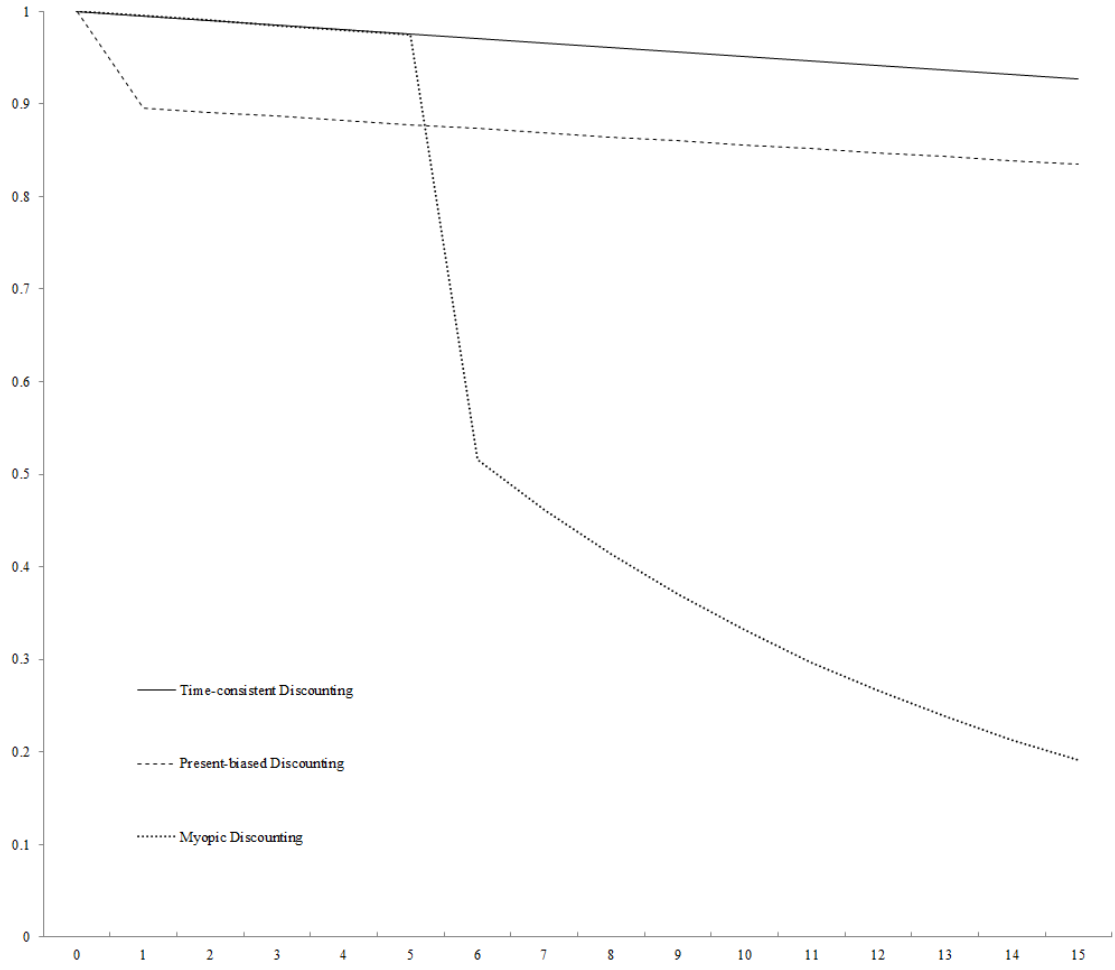

FIGURE 1 DISCOUNT FUNCTIONS

Note: This figure graphs the time-consistent discount function (assuming that $\delta = 0.995$), the present-biased discount function (with $\beta = 0.90$ and $\delta = 0.995$), and the myopic discount function (assuming that $\beta = 0.90$, $\delta = 0.995$ and $t' = 5$).

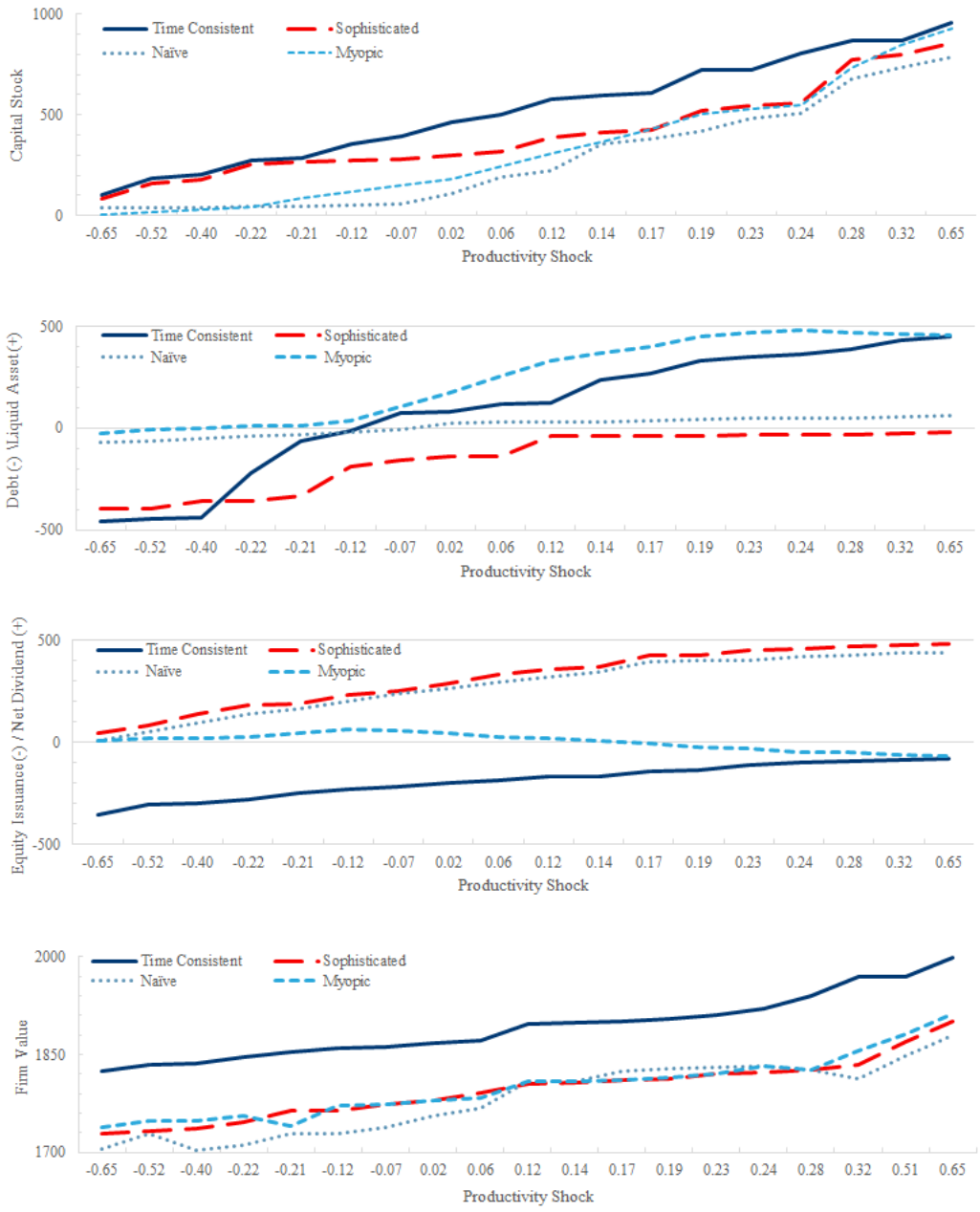

FIGURE 2 SIMULATION RESULTS UNDER DIFFERENT TIME PREFERENCES

This figure graphs the simulation results for my dynamic investment model using parameters summarized by Table 6. In the model, I compare investment (plot 1), financing and dividend decisions (plot 2 and 3) of the firm with (i) a time-consistent manager, (ii) a sophisticated present-biased manager, (iii) a naïve time-inconsistent manager, and (iv) a myopic manager. The effect of different time preferences on firm value is presented in the last plot.

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