High-Cash Holdings and the Firm Life Cycle

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Abstract

We investigate the relationship between firm maturity and high-cash holdings, by examining the determinants of whether a firm is a high-cash outlier. Our premise is that young firms with high growth opportunities will retain any earnings and accumulate high-cash balances; while mature firms with lower growth opportunities will distribute earnings as dividends and have lower cash balances. Consequently, there is an intimate relation between high-cash holdings, dividend policy, and the firm life cycle.

Consistent with the life-cycle thesis, we find empirical support for our hypothesis and show that younger firms with lower earned capital ratios are more likely to be high-cash outliers regardless of dividend policy. Furthermore, our logit analysis shows that both dividend-paying and non-paying firms with better investment opportunities (higher market-to book ratios) and lower leverage (higher total equity ratios) are more likely to be high-cash outliers. With respect to high-cash levels, we report an interesting difference between dividend payers and non-payers regarding the relation to profitability. For non-paying firms, lower profitability increases the probability of having high-cash holdings. Conversely, dividend payers with higher profitability are more likely to be high-cash outliers.

Introduction

Much media attention is focused on the current record levels of cash reported on corporate balance sheets.[1] Although several recent studies investigate the reasons for the increase in cash holdings, Bates et al. (2009) claim that the increase in cash holdings is closely related to the disappearing dividends reported by Fama and French (2001). Furthermore, Bates et al. (2009) show that the time trend of cash holdings for dividend payers is different from non-dividend payers. The Opler et al. (1999) and Bates et al. (2009) studies both show that firms that pay dividends have lower cash holdings; consequently there is a strong relationship between dividend policy and cash holdings.

Other than the media attention directed towards companies with current high-cash holdings, there is much academic and practitioner interest in the high-cash holdings. For example, given the widespread development and implementation of enterprise resource planning (ERP) software, one would expect corporations to be trending to lower levels of all forms of currents assets. Bates et al. (2009) also point out that improvements in information and financial technology should lead to lower corporate cash levels. Students of finance as well as activist investors recognize Jensen's (1986) arguments for the agency costs of free cash flow due to the accumulation of cash if corporations accumulate excessive cash. For example, activist Carl Icahn publically demanded that Apple reduce its $150 billion cash holdings and repurchase its shares.[2]

In this study we focus on high-cash outliers and empirically explore the connection between high-cash holdings, the firm life cycle, and dividend policy. We consider a firm to be a

[1] http://www.bloomberg.com/news/2014-03-31/apple-leads-u-s-companies-holding-record-1-64-trillion.html
[2] http://online.wsj.com/news/articles/SB10001424052702304558804579374720149630510

high-cash outlier in year t if its cash to assets ratio in year t is in the top decile of sample firms.[3] For a proxy for firm life-cycle we borrow from the dividend policy literature the DeAngelo et al (2006) firm life-cycle model or maturity hypothesis. Grullon, Michaely, and Swaminathan (2002) propose the "maturity hypothesis" to describe the process in which changes in dividend policy relate to a firm's transition from a high growth phase to a lower growth phase. Furthermore, DeAngelo and DeAngelo (2006 and 2007) sketch a life-cycle model for dividends in which firms trade-off the costs and benefits of earnings retention. Empirical tests of the maturity hypothesis confirm that young firms with high growth opportunities retain earnings while mature firms with lower growth opportunities distribute earnings as dividends. Our life-cycle premise for high-cash holdings is that young firms with high growth opportunities will retain any earnings and accumulate high-cash balances; while mature firms with lower growth opportunities will distribute earnings as dividends and have lower cash balances. Consistent with the precautionary motive to hold cash, young firms early in the life cycle tend to be non-payers and hold higher median cash levels due to limited access to external credit. Furthermore, the life-cycle model is consistent with the transaction motive to hold cash since larger, more mature firms, will hold less cash due to economies of scale.

The prior literature and our results show that indeed dividend paying firms have lower median cash ratios than non-payers. We further expect that the cash levels of non-payers will respond differently than the cash levels of dividend payers since non-payers are in a different part of the life cycle. To investigate the relationship between dividend policy and high-cash holdings further than the prior literature, we define high-cash outliers and conduct our analysis in separate samples of dividend payers and non-payers.

[3] The choice of the top decile as the cutoff for a high-cash outlier is admittedly arbitrary. In a robustness check we identify high-cash outliers as firms with cash to assets ratios greater than the sample median. Results using this alternative outlier definition are similar to our reported results.

Univariate analysis shows that both the dividend-paying and non-paying, high-cash outliers are less mature, have better investment opportunities and, have higher equity (lower leverage) consistent with our life-cycle premise. We also find strong industry effects. For example, over 80% of the non-paying, high-cash outliers are in the Health Care and Technology sectors. Logit regressions on the probability that a firm is a high-cash outlier confirm much of the univariate analysis. For both non-payers and payers, younger firms with lower earned capital ratios are more likely to be high-cash outliers even after controlling for firm risk. Overall, our results support the life-cycle model and the precautionary motive to hold cash where firms hold cash to deal with adverse shocks when access to capital is costly. For both dividend payers and non-payers, firms with greater investment opportunities (higher M/B ratios) and high equity ratios (or low leverage) have an increased probability of being high-cash outliers. Since both dividend-paying and non-paying firms that have better investment opportunities have higher cash holdings, we find no cross-sectional support for the agency motive for firms to hold cash.

Also consistent with the life-cycle model, we find that for non-paying firms, lower profitability increases the probability of having high-cash holdings. Our explanation is that young firms with investment opportunities lack sufficient cash flow from operations and utilize external capital to fund growth. On the other hand, higher profitability increases the probability of high-cash levels for dividend paying firms. Our life-cycle explanation is that the source of cash for dividend payers is operating cash flow since generally dividend payers are more mature and profitable.

The transaction motive of holding cash, where large firms hold less cash due to economies of scale, is also consistent with our logit results for dividend payers, where firm size (as measured by the NYSE percentile) is negatively and significantly (at the 1% level) related to

the probability of being a high-cash outlier. Overall, our empirical results support the life-cycle model for high-cash holdings.

2. Literature Review

In this section, we review the relevant research on corporate cash holdings, the firm life cycle, and dividend policy related to this study.

2.1 Motives to hold cash

The prior literature identifies four primary motives for firms to hold cash. The first motive is the *transaction costs motive*, which arises from the cost to convert cash substitutes into cash. Classic financial models such as the Baumol (1952) model derive the optimal level of cash when a firm incurs a transaction cost. The Miller and Orr (1966) model indicates that there are economies of scale with cash management; consequently large firms hold less cash.

The *precautionary motive* results from the need to hold cash in reserve in order to deal with random fluctuations in cash flow. Opler et al. (1999) find evidence that supports the precautionary motive as their results show that firms with riskier cash flows and poor access to external capital hold more cash. The precautionary motive seems to be the major reason cited for the recent record amounts of cash. Bates et al. (2009) indicate that firm cash ratios increase because firms' cash flows become riskier. In addition, firms hold fewer inventories and less receivables and are incurring increasing R&D expenses. Consequently, Bates et al. (2009) claim that the precautionary motive plays an important role in explaining the trend in increasing cash ratios. Sanchez and Yurdagul (2013) further the precautionary motive as the explanation for the recent increase in cash holdings since they show that uncertainty correlates well with cash holdings in the cross section of firms. Sanchez and Yurdagul (2013) then conclude that the aggregate uncertainty is an important factor for the trend in increased cash holdings. Another

rationale for the precautionary is advanced by Harford et al. (2014). They argue that firms hold cash to mitigate debt rollover risk and report evidence supporting the argument.

The *tax motive* to hold cash occurs when U.S. corporations would incur tax consequences associated with repatriating foreign earnings as Foley et al. (2007) discuss. Pinkowitz et al. (2012) show that the cash holdings of American multinational companies increase sharply, but the increase in cash holdings of multinational firms cannot be explained by the tax treatment of profit repatriations. While the tax motive is very much a current political issue[4], we do not address the issue of taxes in our research.

As Jensen (1986) discusses, the *agency motive* transpires when entrenched managers would rather retain cash than make distributions to shareholders even when the firm has poor investment opportunities. Jensen (1986) further argues that accumulating cash when a firm has poor investment opportunities leads mangers to accept negative NPV projects, overpay for acquisitions, or make wasteful expenditures. Dittmar and Mahrt-Smith (2007) and Pinkowitz et al. (2006) show that cash is worth less when agency problems are greater. Bates et al. (2009) find no consistent evidence that the agency motive significantly contributes to the recent increase in cash ratios.

2.2 Financially Constrained Firms

While the Opler et al. (1999) study investigates determinants of cash holdings that are consistent with the precautionary motive to hold cash, Ameida et al. (2004) model the precautionary demand for cash and find that financially constrained firms invest in cash out of cash flow but unconstrained firms do not. The empirical results of Han and Qui (2007) indicate that cash holdings of constrained firms increase with cash flow volatility. Riddick and Whited (2009) develop a structural model to determine the effects of financial constraints on corporate

[4] http://online.wsj.com/articles/firms-to-feel-tax-inversion-crackdown-for-now-1411504445

investment, cash, and savings. Bolton et al. (2011, 2013) use dynamic structural models to show that firms value financial slack and accumulate cash to mitigate financial constraints.

2.3 Cash and Strategic Management

Recent finance literature demonstrates that cash holdings have a critical role in the strategic management of the firm. Fresard (2010) shows that firms with cash reserves larger than their rivals gain market share at the expense of their rivals. These cash-rich firms utilize their cash reserves to invest in R&D, fixed assets, and their labor force. Furthermore, the competitive effect of cash is enhanced when the rivals face financial constraints.

While both Opler et al. (1999) and the Bates et al. (2010) studies show that cash levels increase with R&D activity, Brown and Peterson (2011) show that firms use the cash reserves to smooth their R&D expenditures. Moreover, firms most likely to face external financing difficulties rely extensively on cash holdings to maintain R&D investments indicating that R&D smoothing with cash reserves is an important factor in cash management.

Ditmar (2008) indicates that cash policy can be managed with stock repurchases. Although dividends are also a potential solution, repurchases provide a flexible mechanism for paying out excess cash. Empirical evidence indicates that companies with greater uncertainty about their income are more likely to use repurchases. Dittmar (2008) also reports that management completes stock repurchases to buy back undervalued stock. Finally, Hauser (2013) shows that dividend paying firms cut their dividends by more than expected in the 2008-2009 financial crisis in order to build cash reserves when credit was tightened.

2.4 Dividend Policy and the Life-Cycle

One of the most comprehensive explanations for corporate dividend policy is the maturity or life-cycle hypothesis. In their empirical investigation defining the characteristics of dividend

payers, Fama and French (2001) discuss the impact of new listings on the population of firms. Although they imply a firm life-cycle with the discussion of new listings not having the characteristics of dividend payers, Fama and French (2001) do not discuss or test life-cycle variables. Rather, Grullon et al. (2002) formalize the discussion of the maturity hypothesis and dividend policy. Grullon et al. (2002) suggest that dividends convey information about changes in a firm's life-cycle[5]. They postulate that changes in dividends indicate a firm's transition from a high growth phase to a mature phase. The key variable that Grullon et al. (2002) utilize to define the firm maturity is systematic risk.

When Julio and Ikenbeery (2004) test the maturity hypothesis and explain disappearing and reappearing dividends, they use firm age as the variable to define the firm maturity. Julio and Ikenberry (2004) find support for the maturity hypothesis as firm age is related to the probability that a firm pays dividends. DeAngelo et al. (2006) use a different variable to define the firm's life cycle, the earned capital ratio. Based on controlling for the earned capital ratio, DeAngelo et al. (2006) report that that a firm's propensity to pay dividends is significantly related to the earned capital ratio. Hoberg and Prabhala (2009) regard risk as a proxy for firm maturity and show that the firm's probability of paying a dividend is greater when the risk is lower. Our proposition is that we can apply the DeAngelo et al. (2006) life-cycle model to high-cash holdings given the relation between dividend policy and cash holdings. Although the Opler et al. (1999) and the Bates et al. (2010) studies imply a relation between cash holdings and maturity, our research explicitly tests for the life-cycle relation. In the ensuing sections we discuss our data and methodology followed by our empirical results.

[5] The concept of a firm life-cycle with growth stages is generally attributed to Mueller (1972).

3. Data and Methodology

3.1 Data Sample

The sample is taken from the Center for Research in Security Prices (CRSP) and Compustat over the 1982-2010 time period.[6] We exclude financial firms and utilities by excluding those firms with Standard Industrial Classification (SIC) codes in the intervals of 4900-4949 and 6000-6999. The analysis only considers NYSE, NASDAQ, and AMEX industrial firms that have CRSP share codes of 10 or 11 and that are incorporated in the United States according to Compustat. These restrictions eliminate ADRs, closed-end funds, ETFs, and real estate investment trusts (REITs). To be included in the sample, a firm must have non-missing annual data values for dividends and financials from Compustat, as well as return data from CRSP. Following DeAngelo et al. (2006), firms with negative total equity are removed from the sample.

3.2 High-Cash Outliers

In this research, we focus on high-cash outliers. Since Bates et al. (2009) show an effect of dividend policy on the cash ratio, we first divide the sample into dividend payers and non-payers. The prior literature also shows that the average cash ratio changes significantly over time; consequently, we define dividend-paying and non-paying, high-cash outliers in each sample year. For the subsample of dividend payers, we define the dividend-paying, high-cash outliers as dividend paying firms in year t, that are in the top 10 percent of dividend-paying firms with the highest cash to total asset ratios. Likewise, we define the non-paying, high-cash outliers as non-paying firms in year t, that are in the top 10 percent of non-paying firms with the highest cash to total asset ratios.

[6] Since the models require prior growth rates, the data series actually begins in 1981.

3.3 Dependent Variable

In this study, the dependent variable is the firm's status in year t as a high-cash outlier. Thus, the dependent variable is a dummy variable that is assigned a value of one if the firm is a high-cash outlier in year t, and zero otherwise. Table 1 summarizes the variable definitions we utilize in this paper.

3.4 Life-cycle or Maturity Variables

Prior research shows that firm age, the retained earnings to total assets **(RE/TA)**, and risk significantly explain a firm's dividend policy when tested individually. Julio and Ikenberry (2004) test the maturity hypothesis with the logarithm of the firm age. They show that the firm's propensity to pay dividends increases with the logarithm of the firm age; consequently, we follow Julio and Ikenberry (2004) and use **the firm age** for this dimension of maturity. The proxy for firm age is the number of years that the firm is in existence in the CRSP database.

DeAngelo et al. (2006) test the maturity or life-cycle hypothesis with the earned capital ratio with the retained earnings to total equity ratio (RE/TE) and with the retained earnings to total asset ratio (RE/TA). They show that the propensity to pay dividends increases with higher values of RE/TE or RE/TA as these variables characterize the firm's "financial" stage in the life cycle. Following DeAngelo et al. (2006), we use the retained earnings to total assets **(RE/TA)** for this dimension of maturity.

3.5 Control Variables

The control variables for this study are 1) current return on assets, **ROA**, for the measure of profitability; 2) the **market to book ratio** to capture growth opportunities; 3) the **NYSE market capitalization percentile** as the measure of firm size; 4) the total equity to total asset

ratio, or **TE/TA as** a measure of leverage; and, 5) the **standard deviation of the firm's monthly returns** as a measure of risk.

A firm's economic sector should affect dividend policy and cash holdings as the firm's growth potential is related to the overall industry. To control for the economic sector in regressions, we assign each observation with a dummy variable representing the S&P economic sectors listed in Compustat. The dummy industry variable is assigned a value of one if the firm is contained in the S&P economic sector and zero otherwise. Note that in order to have linear independence in the regression models with industry sectors, the Materials sector dummy variable is omitted. Therefore, the coefficients on the remaining industry dummy variables represent the change from the Materials economic sector.

3.6 Panel Logit Model

In the prior dividend life-cycle literature, Fama and French (2001), Julio and Ikenberry (2004), DeAngelo et al. (2006), and Hoberg and Prabhala (2009) use the Fama and MacBeth (1973) time series averages of the annual cross-sectional logit coefficients as described above. Instead, we follow the method used by Hauser (2013) who uses a panel logistic regression to investigate the decision to pay dividends and the decision to cut dividends. In this study, the panel logit model provides a model for the probability that a firm is a high-cash outlier given its dividend paying status.

4. Empirical Results

4.1 Summary Statistics

In this section, we report the findings of the empirical analysis of the relationship between firm maturity and high-cash holdings. Consistent with the prior literature, we find that non-payers have a higher median Cash/TA ratio (.1115) than dividend payers (.0551); however,

we wish to investigate the relationship between the life cycle, dividend policy, and high-cash holdings in more detail. Thus, we then sort both the payers and non-payers into deciles according to the CRSP age such that decile 1 has the 10% of the sample with the lowest CRSP ages and decile 10 contains the 10% of the sample with the highest CRSP ages. Based on the prior literature on the determinants of cash holdings, we expect higher median cash holdings for young firms that have high risk and high growth potential. In Table 2, we report the median summary statistics in each CRSP age decile for the non-payers. As expected for the non-payers, the median Cash/TA ratio is highest in the lowest decile of CRSP age. Our interpretation is that the non-payers with the lowest CRSP ages are the firms in the earliest life-cycle stage. The median cash to assets ratio is highest since these early stage firms have the highest growth potential (based on M/B or Sales Growth Rate). Since the growth potential is large, the early life-cycle firms do not pay a dividend, which is also consistent with a low RE/TA (or low RE/TE) ratio. The median Cash/TA ratio generally declines with higher CRSP age deciles. Likewise as the CRSP age decile increases, the M/B and Sales Growth Rate decline. The inference seems to be that as non-paying firms mature in age, median cash holdings decline as investment opportunities decline. It is interesting to note that as non-payers mature (and the CRSP age decile increases), the earned capital RE/TA and RE/TE ratios increase, but the median market capitalization does not increase. Firms in the Consumer Discretionary, Health Care, and Technology sectors are more prevalent in the youngest CRSP age decile than in the oldest CRSP age decile. On the other hand, firms in the Energy and Industrials sectors are more prevalent in the oldest CRSP age decile than in the youngest CRSP age decile.

In Table 3, we report the median summary statistics in each CRSP age decile for the dividend payers. For the dividend payers, the median Cash/TA ratio shows no trend with CRSP

age decile. For both the dividend payers and the non-payers, the median Sales Growth Rate and median risk declines with increasing CRSP age decile. Based on the prior literature, we expected the median cash to asset ratio to decline since the investment opportunities and risk decline with increasing CRSP age. It is interesting to note that as dividend payers mature (and the CRSP age decile increases), the earned capital RE/TA and RE/TE ratios generally increase, *and* the median market capitalization increases as well. Our interpretation is that dividend payers and non-payers have different responses to variables related to corporate cash holdings due to different life-cycle stages. Although we note the differences between payers and non-payers; an investigation of the determinants of corporate cash holdings is outside the scope of this research. Rather we focus on the relationship between high-cash holdings and the firm life cycle. Furthermore, our research is limited to finding these relationships, and an investigation into the causality between maturity and high-cash holdings is left for further research.

For dividend payers, firms in the Consumer Discretionary and Technology sectors are more prevalent in the youngest CRSP age decile than in the oldest CRSP age decile. On the other hand, firms in the Consumer Staples and Industrials sectors are more prevalent in the oldest CRSP age decile than in the youngest CRSP age decile. For non-paying firms, the percentage of firms in the Health Care and Technology sectors increases steadily until the late 1990's and then increases sharply until about 2005. Consistent with the prior literature, the recent record level of cash holdings has much to do with the industry composition. It is widely reported that high levels of R&D expenses and risky cash flows lead to increased corporate cash holdings. We find that this trend in increased concentration of Health Care and Technology sectors is mostly limited to non-payers; meanwhile, the trend in increased Cash/TA is mostly related to non-payers.

4.2 High-Cash Outliers

In the next analysis, we separate the dividend-paying, high-cash outliers and the non-paying, high-cash outliers. Consistent with the prior literature, we show in Figure 1 that the trend in the median Cash/TA ratio over the 1982-2010 sample period differs for dividend paying firms and non-paying firms, excluding the high-cash outliers. For dividend paying firms, the median Cash/TA ratio actually declines from 1982- 2000, but then increases sharply after 2000 so that median Cash/TA ratios for dividend payers are higher in 2010 than 1982. For non-paying firms, the median Cash/TA ratio increases slowly from 1982-2000, but then increases sharply after 2000.

In Table 4, we show the median characteristics of non-paying, high-cash outliers from the remaining (90%) of the non-payers. It is clear that the non-paying, high-cash outliers have lower median firm maturity by any measure. For the high-cash outliers, the median CRSP age and median earned capital ratio (RE/TE or RE/TA) are significantly lower (at the 1% level) while the median standard deviation is higher. The non-paying, high-cash outliers show no significant difference in size as a measured by the median NYSE percentile. Consistent with the prior literature, non-paying, high-cash outliers have greater investment opportunities. For the high-cash outliers, the median Sales Growth Rate and M/B ratio are significantly higher (at the 1% level). Also consistent with the prior literature, non-paying, high-cash outliers have lower profitability. For the high-cash outliers, the median ROA and ROE are significantly lower (at the 1% level). Similarly, high-cash outliers have much higher median equity ratios (or much lower leverage ratios). Over 80% of the non-paying, high-cash outliers are in the Health Care and Technology sectors.

In Table 5, we show the median characteristics of dividend-paying, high-cash outliers and the remaining (90%) of the dividend payers. The dividend-paying, high-cash outliers have the

lower median CRSP age and higher median standard deviation (measures of lower firm maturity). The dividend-paying, high-cash outliers are significantly smaller as measured by the median NYSE percentile and have greater investment opportunities as measured by the median M/B ratio. Dividend-paying, high-cash outliers have much higher median equity ratios (or much lower leverage ratios). Technology sector firms are much more prevalent among the high-cash outliers than the remaining dividend payers.

We find that dividend-paying, high-cash outliers are much more profitable than the remaining dividend payers. For the high-cash outliers, the median ROA and ROE are significantly higher (at the 1% level). Note that this relationship is opposite to the non-paying, high-cash outliers which had *lower* profitability. In Figure 2 we show the median ROA for dividend paying and non-paying, high-cash outliers for the 1982-2010 time period. We find that the median profitability (as measured by ROA) is much greater for dividend-paying, high-cash outliers than non-paying, high-cash outliers. Interestingly, the time series trend of median ROA for dividend-paying, high-cash outliers is rather flat while the trend of median ROA of non-paying, high-cash outliers is generally declining.

Overall, the univariate results indicate that the median high-cash outlier has a lower median firm maturity regardless of dividend policy. Also concurrent with our life-cycle hypothesis, the median high-cash outlier has better investment opportunities as measured by the M/B ratio. To further investigate the life-cycle model in a multivariate setting, we perform logit analysis in the next section.

4.3 Logit Regressions

For the logit analysis, the dependent variable is a binary dummy variable indicating whether the observation is a high-cash outlier or not. Since we have divided the sample into

dividend payers and non-payers, we have a separate binary (high-cash outlier or not) variable for the dividend payers and the non-payers. Unlike prior studies, this enables us to investigate the response of each independent variable (including the maturity variables) separately for dividend payers and non-payers. Therefore our logit analysis provides the probability that an observation is a high-cash outlier, given that the observation is either a dividend payer or not. We consider three regression models for the logit analysis – (1) a pooled regression with economic industry sector dummy variables but without year effects; (2) a panel regression with year effects and economic industry sector dummy variables; and (3) a panel regression with year effects and firm effects.

Table 6 summarizes the logit regressions for the probability to be a non-paying, high-cash outlier. The firm maturity variables, CRSP age and RE/TA are significant and negatively related to probability of being a non-paying, high-cash outlier in each of the regression models. Consequently for non-payers, younger firms with lower earned capital ratios are more likely to be high-cash outliers even when controlling for firm risk. The risk (or standard deviation of returns) is positively related to the probability of being a high-cash outlier but is significant in only one of the regression models. In each of the regression models, the M/B ratio and the TE/TA ratio are significantly positively related to the probability of being a non-paying, high-cash outlier. Therefore for non-payers, firms with greater investment opportunities (higher M/B ratios) and high equity ratios (or low leverage) have an increased probability of being high-cash outliers. Financial profitability (as measured by ROA) is significantly and negatively related to the probability of being a non-paying, high-cash outlier. Consequently for non-payers, firms with lower profitability have a higher probability of having high-cash holdings. Finally, the regression

models with industry effects indicate that firms in health care and technology are more likely to be non-paying, high-cash outliers.

Table 7 summarizes the logit regression for the probability to be a dividend-paying, high-cash outlier. The firm maturity variables, CRSP age and RE/TA are significant and negatively related to probability of being a dividend-paying, high-cash outlier in each of the regression models. Consequently for both non-payers and payers, younger firms with lower earned capital ratios are more likely to be high-cash outliers even when controlling for firm risk. Overall, these empirical results provide support for the life-cycle model and the precautionary motive to hold cash where firms hold cash to deal with adverse shocks when access to capital is costly. Since less mature firms will be less able to cope with adverse shocks, less mature firms hold more cash.

As we show in Table 7, the risk (or standard deviation of returns) is positively related to the probability of being a dividend-paying, high-cash outlier and the risk is significant in all of the regression models. Although the firm maturity variables all indicate that lower levels of maturity increase the probability of being a high-cash outlier for dividend payers and non-payers, the importance of each maturity variable depends on dividend policy. For dividend-payers, age has less impact on the probability of being a high-cash outlier than it does for non-payers. Similarly, the earned capital ratio has a greater effect on the probability of being a dividend-paying, high-cash outlier than on the probability of being a non-paying, high-cash outlier. Finally, risk increases the probability of being a dividend-paying, high-cash outlier while risk is not statistically significant to the probability of being a non-paying, high-cash outlier in all of the regression models.

In each of the regression models, the M/B ratio and the TE/TA ratio are significantly positively related to the probability of being a dividend-paying, high-cash outlier. Therefore for both dividend payers and non-payers, firms with greater investment opportunities (higher M/B ratios) and high equity ratios (or low leverage) have an increased probability of being high-cash outliers. Since both dividend-paying and non-paying firms that have better investment opportunities have higher cash holdings, we find no cross-sectional support for the agency motive for firms to hold cash, which is consistent with the findings of Bates et al. (2009). Financial profitability (as measured by ROA) is significantly and positively related to the probability of being a dividend-paying, high-cash outlier. Consequently for dividend payers, firms with higher profitability have a higher probability of having high-cash holdings. Our explanation for the opposite response to profitability for dividend payers and non-payers is that the "source" of the high level of cash may be different between dividend-payers and non-payers. It is likely that the "source" of the high-cash levels for dividend payers is cash flow from operations while the "source" of the high-cash levels for non-payers is external financing, which is consistent with our life-cycle proposition. While this is a potential explanation, investigation of the "source" of high-cash levels is outside the scope of this research.

For dividend payers, firm size (as measured by the NYSE percentile) is negatively and significantly (at the 1% level) related to the probability of being a high-cash outlier. This is consistent with the transaction motive of holding cash where large firms hold less cash due to economies of scale. Interestingly for non-payers, the firm's size coefficient is less significant and has a less effect on the probability that a non-payer is a high-cash outlier. Overall, we find empirical evidence to support the life-cycle model for high-cash holdings.

4.4 Robustness Tests

In order to test the robustness of our results, we again divided the sample into dividend payers and non-payers. In each year t, we find the median Cash/TA for the dividend payers and non-payers. For the robustness tests, we then divide the dividend payers into payers with above median Cash/TA ratios in year t and payers with below median Cash/TA ratios in year t. Firms above the median Cash/TA ratio serve as a proxy for firms with "high-cash" holdings in the robustness tests. Likewise; we divide the non-payers into samples with above median Cash/TA ratios in year t and below median Cash/TA ratios in year t.

In unreported Tables we find that non-payers with Cash/TA ratios above the median have lower median CRSP age and lower median earned capital ratio than non-payers with below median Cash/TA ratios, which indicates that non-payers with above median Cash/TA have lower median firm maturity. Likewise, non-payers with above median cash holdings have higher standard deviation. The non-payers with the above median Cash/TA ratios also have higher M/B ratios (better growth opportunities) and higher TE/TA ratios. Non-payers with above median cash holdings have lower profitability than non-payers with below median CA/TA ratios. In general, the non-payers with the above median Cash/TA ratios typically have the characteristics of the non-paying, high-cash outliers. We also find (but do not report in Tables for brevity) that dividend payers with above median Cash/TA ratios generally have the characteristics of the dividend-paying, high-cash outliers.

Panel logit analysis confirms the firm maturity variables, CRSP age and RE/TA are significant and negatively related to probability of having an above median Cash/TA ratio. Therefore, the relationship between firm maturity and the probability of being a firm with high-cash holdings remains regardless of whether one defines a firm with high-cash holdings as above

the median Cash/ TA ratio (in year t) or in the highest 10 percent of Cash/TA ratios (in year t). Overall, the robustness tests confirm our life-cycle analysis of the high-cash outliers.

5. Summary and Conclusions

The main theme of this research is that high-cash holdings are related to the firm life-cycle. To investigate this relationship further than the prior literature, we investigate firm maturity variables and separate dividend payers from non-payers in order to analyze the probability that a firm is a dividend-paying, high-cash outlier or a non-paying, high-cash outlier. Our analysis by firm age shows that the median Cash/TA ratio declines with median age for non-payers. This confirms our assertion that firm maturity is related to cash holdings. We find that young firms early in the life cycle tend to be non-payers and hold higher median cash level, which is consistent with the precautionary motive to hold cash due to young firms' limited access to external credit.

To study high-cash holdings, we define high-cash outliers to be in the top 10 percent of firms with the highest Cash/TA ratios in year t. Univariate analysis shows that both the dividend-paying and non-paying, high-cash outliers are less mature, have better investment opportunities and, have higher equity (lower leverage). We find strong industry effects with the high-cash outliers; for example, over 80% of the non-paying, high-cash outliers are in the Health Care and Technology sectors. The multivariate logit regressions on the probability that a firm is a high-cash outlier confirm much of the univariate analysis. For both non-payers and payers, younger firms with lower earned capital ratios are more likely to be high-cash outliers.

For both dividend payers and non-payers, firms with greater investment opportunities (higher M/B ratios) and high equity ratios (or low leverage) have an increased probability of being high-cash outliers. Since both dividend-paying and non-paying firms that have better

investment opportunities have higher cash holdings, we find no cross-sectional support for the agency motive for firms to hold cash. The transaction motive of holding cash, where large firms hold less cash due to economies of scale, is consistent with the life-cycle model for dividend payers, where firm size (as measured by the NYSE percentile) is negatively and significantly (at the 1% level) related to the probability of being a high-cash outlier. We find that lower profitability increases the probability of having high-cash holdings non-payers while higher profitability increases the probability of high-cash holding for dividend paying firms. In robustness tests, the relationship between firm maturity and the probability of having high-cash holdings persists regardless of whether one defines a firm with high-cash holdings as above the median Cash/ TA ratio (in year t) or a high-cash outlier in the highest 10 percent of Cash/TA ratios (in year t).

While we find empirical support for the relationship between the firm life cycle and high-cash holdings; future research might examine the relationship between the life cycle and the complete cross section of cash holdings. Although it is outside the scope of this research, future research might also investigate the causal effects between firm maturity and cash holdings.

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Table 1 Variable Definitions

Variable	Definition
Age	Time in years that the firm entity (Permno) has had Price data available in the CRSP database.
Std Dev of Returns	The standard deviation of monthly returns for the year.
RE/TE	Ratio of retained earnings to total shareholders' equity
RE/TA	Ratio of retained earnings to total assets
NYSE Percentile	The percentile ranking of firm's market equity. NYSE market equity capitalization percentile breakpoints provided at Dr. Kenneth R. French's website, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
Sales Growth Rate	Sales growth rate, which equals (sales t / sales t-1) - 1
ROA	Return on assets in current year t
ROE	Return on equity in current year t
Cash/TA	Cash to total asset ratio
TE/TA	total equity to total asset ratio
M/B	Book assets minus book equity plus market equity all divided by book assets. Where, Market Equity= Year closing price times shares outstanding and Book Equity= Stockholders Equity minus Preferred Stock plus Balance Sheet Deferred Taxes and Investment Tax Credit minus Post Retirement Asset. If Stockholder's Equity is not available, it is replaced by either Common Equity plus Preferred Stock Par Value or Assets minus Liabilities. Preferred Stock is Preferred Stock Liquidating Value or Preferred Stock Redemption
Materials	Dummy variable assigned a value of one if the firm is included in the Materials economic sector as defined by Standard and Poors, and zero otherwise.
Consumer Discretionary	Dummy variable assigned a value of one if the firm is included in the Consumer Discretionary economic sector as defined by Standard and Poors, and zero otherwise.
Consumer Staple	Dummy variable assigned a value of one if the firm is included in the Consumer Staples economic sector as defined by Standard and Poors, and zero otherwise.
Health Care	Dummy variable assigned a value of one if the firm is included in the Health Care economic sector as defined by Standard and Poors, and zero otherwise.
Energy	Dummy variable assigned a value of one if the firm is included in the Energy economic sector as defined by Standard and Poors, and zero otherwise.
Technology	Dummy variable assigned a value of one if the firm is included in the Industrials economic sector as defined by Standard and Poors, and zero otherwise.
Telecom	Dummy variable assigned a value of one if the firm is included in the Telecommunication Services economic sector as defined by Standard and Poors, and zero otherwise.

Table 2. Summary Statistics for Nonpayers by CRSP Age Decile

	CRSP Age Deciles									
Variable	Decile1	Decile2	Decile3	Decile4	Decile5	Decile6	Decile7	Decile8	Decile9	Decile10
CRSP Age –years	2	3	4	5	7	8	11	13	18	27
Std Dev of Monthly Returns-%	16.95%	16.92%	16.82%	16.39%	16.27%	15.21%	14.47%	14.01%	13.83%	12.67%
RE/TE	-0.0248	-0.0309	-0.0549	0.0000	-0.0421	0.0489	0.1221	0.1943	0.2681	0.3800
NYSE Percentile	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Sales Growth Rate-%	32.73%	23.18%	16.04%	12.56%	10.94%	9.84%	8.35%	7.87%	6.62%	5.39%
ROA -%	1.73%	0.73%	0.50%	0.88%	0.79%	1.64%	1.69%	2.27%	2.15%	2.20%
ROE -%	3.56%	1.52%	1.09%	1.94%	1.66%	3.52%	3.54%	4.78%	4.60%	5.07%
Cash/TA	0.1619	0.1335	0.1267	0.1055	0.1228	0.1113	0.1103	0.1054	0.0965	0.0774
RE/TA	-0.0126	-0.0143	-0.0255	0.0000	-0.0213	0.0216	0.0541	0.0877	0.1190	0.1585
TE/TA	0.6122	0.5783	0.5539	0.5357	0.5463	0.5358	0.5468	0.5411	0.5358	0.4831
Cash/TE	0.3116	0.2821	0.2710	0.2413	0.2588	0.2431	0.2326	0.2236	0.2048	0.1872
M/B	1.71	1.55	1.47	1.37	1.46	1.37	1.32	1.325	1.26	1.18
P/S	1.60	1.32	1.17	0.94	1.06	0.95	0.88	0.88	0.77	0.58
% of Firms by Sector										
Materials	3.5%	3.8%	3.8%	3.3%	3.3%	3.4%	3.2%	3.2%	4.2%	7.3%
Consumer Discretionary	23.2%	23.5%	22.1%	23.7%	22.5%	22.3%	21.0%	21.9%	21.4%	20.7%
Consumer Staples	4.1%	4.3%	4.2%	3.8%	3.7%	3.9%	4.6%	4.6%	4.2%	4.4%
Health Care	17.6%	17.4%	17.7%	18.0%	19.4%	18.7%	18.3%	17.4%	17.2%	8.4%
Energy	5.3%	5.4%	6.6%	5.8%	5.3%	6.2%	6.2%	6.0%	6.6%	7.7%
Industrials	14.8%	15.1%	15.4%	15.4%	14.3%	15.5%	16.1%	16.9%	17.7%	25.7%
Technology	28.3%	27.8%	27.5%	27.7%	29.4%	28.1%	28.6%	28.2%	26.7%	23.4%
Telecom	2.2%	1.9%	1.7%	1.4%	1.5%	1.2%	1.2%	1.1%	0.8%	0.8%

Table. 3 Summary Statistics for Dividend Payers by CRSP Age Decile

	CRSP Age Deciles									
Variable	Decile1	Decile2	Decile3	Decile4	Decile5	Decile6	Decile7	Decile8	Decile9	Decile10
CRSP Age –years	4	8	12	14	18	22	26	32	41	65
Std Dev of Monthly Returns-%	10.61%	10.14%	9.55%	9.75%	9.30%	8.62%	8.32%	8.04%	8.40%	7.55%
RE/TE	0.4698	0.6071	0.7193	0.7502	0.7714	0.7809	0.8052	0.8485	0.8648	0.8555
NYSE Percentile	25%	25%	25%	30%	35%	35%	40%	50%	65%	90%
Sales Growth Rate -%	11.18%	8.31%	8.38%	8.32%	8.06%	6.99%	7.04%	5.76%	5.24%	4.76%
ROA -%	5.91%	5.33%	5.85%	5.99%	5.90%	5.76%	5.76%	5.49%	5.46%	5.29%
ROE -%	13.05%	11.40%	12.19%	12.21%	12.03%	11.90%	12.23%	11.95%	12.23%	14.05%
Cash/TA	0.0527	0.0549	0.0705	0.0652	0.0604	0.0602	0.0486	0.0489	0.0544	0.0467
RE/TA	0.2113	0.2779	0.3454	0.3657	0.3770	0.3796	0.3830	0.3933	0.3897	0.3275
TE/TA	0.4882	0.5001	0.5175	0.5163	0.5189	0.5176	0.4916	0.4718	0.4542	0.3841
Cash/TE	0.1266	0.1260	0.1497	0.1409	0.1276	0.1298	0.1059	0.1140	0.1249	0.1354
Dividend Growth Rate-%	9.32%	5.22%	6.82%	6.43%	6.44%	5.97%	5.14%	3.92%	4.22%	4.26%
Dividend Payout Ratio-%	18.12%	19.33%	23.31%	23.44%	24.95%	27.67%	28.20%	30.10%	32.33%	37.80%
M/B	1.42	1.34	1.31	1.34	1.33	1.36	1.36	1.4	1.39	1.38
% of Firms by Sector										
Materials	12.3%	11.3%	10.7%	10.4%	10.8%	10.8%	12.2%	13.0%	16.7%	16.5%
Consumer Discrectionary	24.7%	27.6%	28.9%	29.7%	28.2%	25.5%	26.7%	25.4%	20.2%	20.2%
Consumer Staples	9.7%	9.8%	11.9%	9.8%	9.5%	11.4%	10.8%	11.2%	10.4%	18.5%
Health Care	5.6%	6.2%	6.4%	6.8%	7.3%	6.4%	5.6%	6.3%	7.4%	5.3%
Energy	7.2%	5.6%	4.9%	4.5%	4.6%	4.4%	3.8%	4.5%	6.4%	7.8%
Industrials	25.5%	23.3%	25.2%	26.2%	27.2%	29.2%	29.6%	28.7%	29.7%	27.4%
Technology	10.1%	12.3%	9.0%	10.1%	9.9%	9.1%	8.3%	7.7%	7.0%	3.3%
Telecom	3.3%	2.9%	1.8%	1.5%	1.6%	1.8%	1.9%	1.7%	1.2%	1.0%

Table 4. Summary Analysis of Non-Paying Cash Outliers

Variable	0-90% percentile	Cash Outliers	Z	
Median CRSP Age - years	8	5	37.531	***
Median Std Dev of Monthly Returns %	15.05%	17.63%	-23.836	***
Median RE/TE	0.1213	-0.6790	44.301	***
Median NYSE Percentile	10%	10%	1.432	
Median Sales Growth Rate %	11.19%	17.55%	-7.696	***
Median ROA%	1.83%	-9.67%	34.063	***
Median ROE %	4.07%	-12.33%	33.502	***
Median M/B	1.33	2.41	-49.98	***
Median CA/TA	0.0879	0.6976	-130.048	***
Median RE/TA	0.0518	-0.5317	45.929	***
Median TE/TA	0.5167	0.8107	-79.679	***
N (Observations)	58,516	6,502		

% of Firms br Economic Sector	0-90% percentile	Cash Outliers
Materials	4.16%	1.38%
Consumer Discretionary	23.88%	7.26%
Consumer Staples	4.49%	1.43%
Health Care	14.04%	43.85%
Energy	6.58%	2.06%
Industrials	17.84%	6.31%
Technology	26.58%	36.47%
Telecom	1.46%	0.82%

Statistical significance at the 1%, 5%, and 10% levels are indicated by ***, **, and *.

Table 5. Summary Analysis of Dividend Paying Cash Outliers

Variable	0-90% percentile	Cash Outliers	Z	
Median CRSP Age - years	20	15	20.523	***
Median Std Dev of Monthly Returns %	8.93%	9.60%	-7.672	***
Median RE/TE	0.7604	0.7769	-0.223	
Median NYSE Percentile	45%	20%	28.438	***
Median Sales Growth Rate %	7.20%	6.95%	2.123	**
Median ROA%	5.40%	9.31%	-33.607	***
Median ROE %	12.14%	13.64%	-9.924	***
Median M/B	1.34	1.68	-21.241	***
Median CA/TA	0.0451	0.3740	-91.911	***
Median RE/TA	0.3355	0.5198	-30.819	***
Median TE/TA	0.4617	0.7399	-60.028	***
Median Dividend Growth Rate %	5.26%	7.47%	-7.276	***
Median Dividend Payout %	26.74%	24.66%	0.522	
N (observations)	27,787	3,191		

% of Firms br Economic Sector	0-90% percentile	Cash Outliers
Materials	13.21%	5.99%
Consumer Discretionary	25.75%	25.45%
Consumer Staples	11.65%	8.24%
Health Care	6.04%	8.71%
Energy	5.84%	1.35%
Industrials	27.73%	22.72%
Technology	6.70%	26.01%
Telecom	2.06%	0.25%

Statistical significance at the 1%, 5%, and 10% levels are indicated by ***, **, and *.

Table 6. Logit Regressions for the Probability to be a Non-Paying, High-Cash Outlier
This table shows logit models of the probability of being a non-paying, high-cash outlier, where a high-cash outlier is a firm in the highest 10 percent of Cash/TA ratios in year t. The dependent variable equals one in year t if the firm is in the highest 10 percent of Cash/TA ratios in year t. Variable definitions appear in Table 1. t-statistics are shown in parentheses below each coefficient. Statistical significance at the 1%, 5%, and 10% levels are indicated by ***, **, and *.

	Pooled Regression (Industry dummies)		Panel Regression (Industry dummies)		Panel Regression (Firm effects)	
Variable	Coefficient		Coefficient		Coefficient	
Standard deviation of monthly returns	0.0371		0.3632	***	0.0702	
	(0.29)		(2.69)		(0.36)	
CRSP Age	-0.0614	***	-0.0566	***	-0.1238	***
	(-22.04)		(-19.71)		(-24.98)	
NYSE Percentile	-0.1653	**	0.054		-0.3467	**
	(-1.97)		(0.63)		(-1.96)	
ROA (%)	-0.0058	***	-0.0064	***	-0.0044	***
	(-13.36)		(-14.53)		(-6.97)	
RE/TA	-0.0696	***	-0.0753	***	-0.0891	***
	(-11.2)		(-11.66)		(-8.99)	
TE/TA	5.223	***	5.3763	***	7.2014	***
	(58.25)		(59.01)		(47.29)	
M/B	0.0757	***	0.072	***	0.0802	***
	(15.02)		(13.92)		(11.15)	
Constant	-6.1103	***	-6.2554	***	-7.9316	***
	(-44.72)		(-46)		(-57.68)	
Consumer Discretionary	-0.0058		-0.0813			
	(-0.05)		(-0.72)			
Consumer Staples	-0.0136		-0.1121			
	(-0.08)		(-0.74)			
Health Care	1.5241	***	1.4873	***		
	(12.97)		(14.25)			
Energy	-0.2718	*	-0.4679	***		
	(-1.85)		(-3.42)			
Industrials	0.1798		0.0927			
	(1.42)		(0.81)			
Technology	0.8569	***	0.8135	***		
	(7.29)		(7.81)			
Telecom	0.449	**	0.4082	**		
	(2.31)		(2.18)			

Table 7. Logit Regressions for the Probability to be a Dividend-Paying, High-Cash Outlier
This table shows logit models of the probability of being a dividend-paying, high-cash outlier, where a high-cash outlier is a firm in the highest 10 percent of Cash/TA ratios in year t. The dependent variable equals one in year t if the firm is in the highest 10 percent of Cash/TA ratios in year t. Variable definitions appear in Table 1. t-statistics are shown in parentheses below each coefficient. Statistical significance at the 1%, 5%, and 10% levels are indicated by ***, **, and *.

	Pooled Regression (Industry dummies)		Panel Regression (Industry dummies)		Panel Regression (Firm effects)	
Variable	Coefficient		Coefficient		Coefficient	
Standard deviation of monthly returns	0.99	***	0.7909	*	1.7466	***
	(2.42)		(1.82)		(2.9)	
CRSP Age	-0.0054	***	-0.0048	***	-0.0282	***
	(-3.12)		(-2.69)		(-6.93)	
NYSE Percentile	-1.2634	***	-1.312	***	-1.5079	***
	(-13.05)		(-13.39)		(-6.58)	
ROA (%)	0.026	***	0.0261	***	0.0264	***
	(7.3)		(7.31)		(5.16)	
RE/TA	-0.3563	***	-0.3842	***	-0.7871	***
	(-4.96)		(-5.25)		(-5.5)	
TE/TA	6.3956	***	6.4387	***	8.4687	***
	(40.88)		(40.8)		(28.3)	
M/B	0.2003	***	0.2127	***	0.2729	***
	(10.13)		(10.46)		(8.29)	
Constant	-6.4236	***	-6.3194	***	-8.1663	***
	(-44.98)		(-43.17)		(-35.09)	
Consumer Discretionary	0.6099	***	0.4789	***		
	(6.8)		(5.7)			
Consumer Staples	0.4325	***	0.2896	***		
	(4.03)		(2.82)			
Health Care	0.6751	***	0.5563	***		
	(6.03)		(5.17)			
Energy	-0.6411	***	-0.7608	***		
	(-3.47)		(-4.17)			
Industrials	0.4007	***	0.2632	***		
	(4.43)		(3.1)			
Technology	1.34	***	1.2172	***		
	(14.17)		(13.63)			
Telecom	-0.4509		-0.5525			
	(-1.21)		(-1.48)			

Figure 1. Median Cash to Total Asset Ratio for Dividend Paying and Non-paying Firms (excluding high-cash ratio outliers) 1982-2010

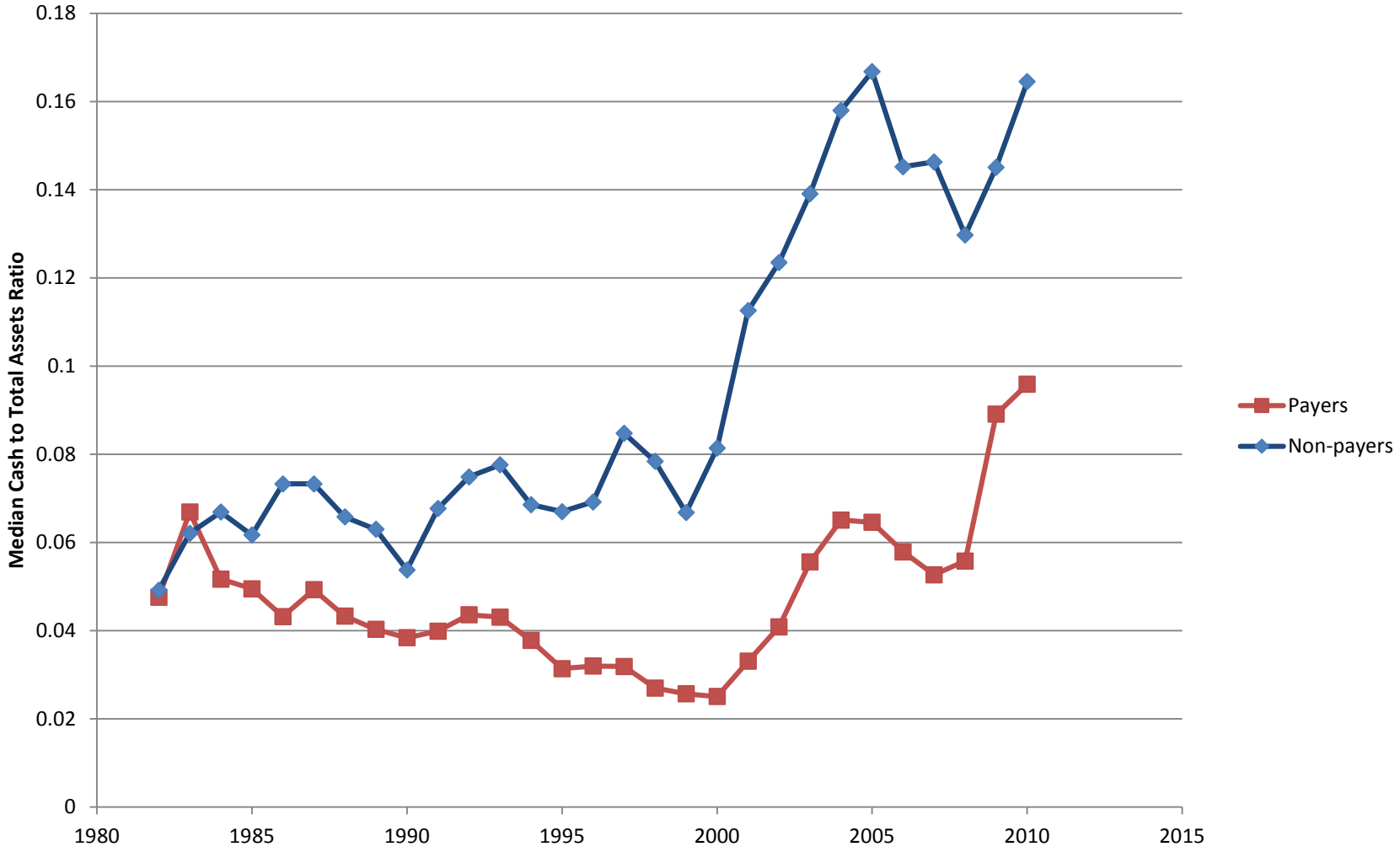

Figure 2. Median Return on Assets for Dividend Paying and Non-Paying High-cash Outliers (1982-2010)