ELSEVIER

Journal of Corporate Finance 8 (2002) 139–158

Journal of CORPORATE FINANCE

www.elsevier.com/locate/econbase

Agency costs and efficiency of business capital investment: evidence from quarterly capital expenditures

Hyun-Han Shin [a,*], Yong H. Kim [b,1]

[a] *Department of Finance and Managerial Economics, School of Management, State University of New York, Buffalo, NY 14260, USA*

[b] *Department of Finance, College of Business Administration, University of Cincinnati, Cincinnati, OH 45221-0195, USA*

Accepted 22 June 2001

Abstract

Using the quarterly Compustat files, we present empirical findings that business capital investment is significantly higher in the fourth quarter than in other quarters. Even after controlling for business capital investment determinants, we find that the fourth quarter capital investment is significantly larger but less sensitive to investment opportunities than other quarters' capital investment. This phenomenon is more evident for firms with larger cash holdings than for firms with smaller cash holdings, for larger firms than for smaller firms, and for diversified firms than for stand-alone firms. Our findings suggest a high level of agency costs in corporate investment decisions.

Keywords: Agency costs; Investment; Quarterly capital expenditures; Cash holdings; Firm size; Diversification

1. Introduction

Agency theory suggests that agency costs in corporations may make business fixed investment inefficient. However, Hubbard (1998) points out that there is very little empirical evidence on the effect of agency costs on the corporate investment, while a large body of literature examines the effect of asymmetric information on business fixed

* Corresponding author. Tel.: +1-716-645-3266; fax: +1-716-645-3823.
E-mail addresses: hanshin@acsu.buffalo.edu (H.-H. Shin), Yong.Kim@uc.edu (Y.H. Kim).
[1] Tel.: +1-513-556-7084; fax: +1-513-556-0979.

0929-1199/02/$ - see front matter
PII: S0929-1199(01)00033-5

investments.[2] We investigate the effect of agency costs on business fixed investment by observing the patterns of quarterly capital expenditure changes.

Capital budgeting theories usually assume that headquarters maximize shareholders' value while divisional managers are empire builders and, therefore, prefer large projects to small projects.[3] For example, headquarters use soft capital rationing to keep managers from building empires in the model of Harris and Raviv (1996, 1998). Given the opportunity to exercise managerial discretion, one might argue that credit (soft) rationing within the firm gives divisional managers a greater incentive to use up the balance of any assigned fixed investment budget before the fiscal year-end to ensure that they have a similar or higher budget next year. In fact, it is a well-known practice among practitioners that managers of capital expenditures use up their budget because unused budgets are typically not transferable across years. Consistent with the implication, we find that corporations make more capital expenditure in the fourth quarter than other quarters.[4] Next, we investigate the relation between the level and efficiency of quarterly capital expenditures and agency costs. We find that the fourth quarter investment is greater than other quarters even after controlling for investment determinants.

Jensen (1986) and Stulz (1990) argue that firms with large cash holdings may invest more than they should. Then, do large cash holdings encourage firms with low growth opportunities to invest more than they should? We address this question to examine the efficiency of investment decisions by firms with large cash holdings. We estimate the sensitivity of the investment depending on the measurement of agency costs. We find that the sensitivity of firms' investment to growth opportunities after size-adjusted is smaller for firms with high cash holdings than for firms with low cash holdings. Furthermore, firms with large cash holdings invest more than firms with small cash holdings do. To the extent that corporate cash holdings proxy for free cash flow, our findings show the relation between capital expenditure and free cash flow. We interpret this as evidence that firms with large cash holdings are more likely to make inefficient investment decisions than firms with small cash holdings.

We also compare the quarterly capital expenditure of large firms with that of small and medium size firms. Since large firms tend to have more divisions and it is more difficult for the headquarters to allocate capital and monitor expenditures efficiently, large firms might have greater agency costs. Then, it is easier for large firm divisional managers to "cheat" the headquarters by using up the budget by the end of the fiscal year. Consistent with this argument, we find that the size-adjusted difference between the first quarter capital expenditure and the fourth quarter capital expenditure is significantly greater but less efficient for large firms than for small and medium size firms.

[2] See, for example, Jensen (1986) and Stulz (1990) for discussion and implication of agency costs in the corporate investment decision making. Recently, Opler et al. (1999) find no supportive evidence of Jensen's free-cash flow hypothesis that cash-rich firms make more investment than firms with lower cash holdings.

[3] See Berkovitch and Israel (1998), Harris and Raviv (1996, 1998) and Stein (1997) for example.

[4] Even though Majd and Pyndyck (1987), Kinney and Trezevant (1993), Bartov (1993), and Callen et al. (1996) find similar results, our focus is different from theirs since we focus on agency costs explanation of quarterly capital expenditures and their efficiencies.

Recent evidence of inefficient investment by diversified (multi-divisional) firms suggests that diversified firms are more likely to make inefficient investment than are single segment stand-alone firms.[5] We compare the quarterly capital expenditure of diversified firms with that of stand-alone firms. We confirm that the capital expenditures are greater but less efficient for diversified firms than for stand-alone firms in all quarters. Furthermore, the difference is more evident in the fourth quarter. Findings that we present are direct evidence of the view that investment is distorted in an internal capital market due to agency costs.

It can be argued that our findings are due to earnings management, since companies frequently manage earnings by adjusting fiscal year-end accruals to achieve a desired level of annual earnings.[6] Indeed, our findings look similar to the consequence of earnings management. However, we find only positive changes in capital expenditures from interim quarters to the fourth quarter while earnings management hypothesis predicts changes in both directions. In order for our findings to be a result of earnings or accrual management, the fourth quarter capital expenditures should not exhibit only one-sided changes. Furthermore, we argue that it is hard to understand why firms with greater agency costs (proxied by the level of cash holding and the degree of diversification) tend to spend more but less efficiently in the fourth quarter than firms with little agency costs if the fourth quarter over-investment is simply due to earnings management.

The remainder of the paper is organized as follows. Section 2 discusses theories regarding agency problem in capital budgeting and capital expenditures, and develops testable implications. Section 3 describes the data. Section 4 investigates the effect of cash holdings, firm size and diversification on the efficiency of corporate investment. Section 5 concludes the paper.

2. Agency problem in capital budgeting and capital expenditures

Brealey and Myers (2000) list empire building as an agency problem in capital budgeting. Empire building is that other things being equal, managers prefer to run large businesses rather than small ones.[7] Taggart (1987) describes the typical capital budgeting procedure in which divisional managers initiate budget proposals and headquarters assign budgets for them. Harris and Raviv (1996, 1998), Stein (1997) and Scharfstein and Stein (1996) acknowledge the possibility that even though headquarters represent shareholders, headquarters allow over-investment in divisions to reduce managers' rent-seeking activities. Both headquarters and divisional managers prefer being in charge of larger firms. When there is an initial capital spending limit for any division, the manager will request a larger amount knowing that the headquarters may allocate a compromised level of capital. Headquarters make decisions about allocating funds to individual or divisional managers based on the proposals by the managers. However, headquarters do not assign the maximum of what the managers request since they know that managers tend to exaggerate claims about the productivity of capital. Instead, headquarters impose capital spending

[5] See Scharfstein (1997), Shin and Stulz (1998), Rajan et al. (1997), and Shin and Park (1999) for evidence.
[6] See Das and Shroff (1998) for evidence.
[7] Chapter 12. Making Sure Managers Maximize NPV, p. 321.

limits on the managers. Jensen and Meckling (1976) also argue that budget restrictions are used as a way to control the behavior of the owner-manager when the owner-manager has a partial ownership and an incentive to expend resources in order to capture non-pecuniary benefits. To wit, capital budgeting literature argues that managers tend to request a higher budget under budget restrictions.

Recognizing that analysis of the investment decisions of firms occupies a prominent place in research programs in corporate finance, Hubbard (1998) summarizes the principal findings of studies that have extended conventional models of business capital investment to incorporate a role for "financing constraints" in determining investment. If the capital market is perfect, corporate fixed investments should not be related to the internal cash flows of the firm. However, when insiders have information that outsiders do not have, the cost of internal capital is lower than the cost of external capital.[8] Therefore, corporate investments may depend on changes in net worth. Alternatively, when managerial and shareholders' incentives differ, managers may invest in non-value maximizing projects.[9] Therefore, for firms with high agency costs, investment is less likely to be correlated with the firm's growth opportunities.

Scharfstein (1997) reports that divisions with good investment opportunities invest less than their single segment stand-alone industry peers, while divisions with poor investment opportunities invest more than their stand-alone industry peers. Lamont (1997) also finds that industry-adjusted levels of profitability and cash flow of non-oil subsidiaries of oil conglomerates are significantly lower than their industry peers, but their investment is not significantly different from industry levels. Shin and Stulz (1998) report that small divisions' capital expenditures are affected by cash flows from other divisions within the diversified firms. Furthermore, Shin and Stulz (1998) and Rajan et al. (1997) find inefficient internal allocation of funds for diversified firms.[10] Scharfstein and Stein (1996) call this practice a kind of "socialism" in capital budgeting, where headquarters give more resources to under-performing divisions to reduce their managers' perk-seeking activities.

Previous theoretical work suggests that outside shareholders use budget constraints to control agency problems. However, bureaucracy in the capital budgeting process may cause managers to consume any budget balance before it expires at the end of the fiscal year. Furthermore, socialism in capital budgeting implies that divisions may have equal amounts of budgets irrespective of divisional growth opportunities. In this case, divisions without immediate growth opportunities will wait until positive NPV projects arrive. But if such projects do not arrive, then divisions may spend the budget on any projects. Assuming that a division with any unused budget this year would get a lower budget allocation next year, divisional managers facing soft-rationing would use up the planned budget before the fiscal year-end. This extra consumption of budget by inefficient divisions or firms towards the end of the budget period will result in inefficient investment for a whole firm. The theories and business practices imply less efficient investment in the

[8] See Myers and Majluf (1984).

[9] See, for example, Jensen (1986) and Stulz (1990).

[10] Shin and Park (1999), however, find efficient internal allocation of funds for Korean conglomerates who are largely owned and controlled by founding families and whose divisional growth opportunities and capital expenditure are directly observable. This is consistent with Scharfstein (1997).

fourth quarter than other quarters and that the inefficiency in investment is more prevalent for firms with high level of agency costs.

3. Data

We collect our data from Compustat quarterly tapes for the years from 1984 to 1994, since quarterly capital expenditure is not available before 1984. In order to obtain results comparable to previous research in the business fixed investment literature, we focus on the capital expenditures of manufacturing firms whose SIC falls between 2000 and 3999. Cash holdings and capital expenditures of agricultural, retail, financial and utility companies are different from manufacturing firms, so they are omitted from our sample. In addition, observations with any missing or excess values were deleted from the sample.[11] The 1% tails of the distribution are dropped for all variables to avoid a possible bias in the result caused by outliers Fama and French (1998). The final sample consisted of a total of 69,955 firm-quarter observations. Table 1 presents summary statistics for sample firms for all quarters as well as by each quarter. We use the "Monthly Consumer Price Index for all Urban of the Bureau of Labor Statistics" to normalize total assets and net sales to 1994 dollars. For all firms and quarters, the mean and median real-total assets are 1385 million and 80 million dollars, respectively. The mean and median sales also show the same wide variation: mean sales are about 14 times the median sales. This wide range of firm size in the sample requires standardization of the variables for comparison. In order to make the cash holdings, capital expenditures and other variables comparable among sample firms and to avoid heteroscedasticity in variables, we deflate all variables by total book assets at the beginning of the period.

On average, firms make quarterly investments of 1.64% of total assets. The median capital expenditure is 1.17%. When we turn to the investment for each quarter, we find a steady increase in investment from the first quarter to the fourth quarter. The mean and median capital expenditures in the first quarter are 1.41% and 1.01%, respectively, while those in the fourth quarter are 2.01% and 1.44%, respectively. If firms are financially constrained, they cannot make investments whenever they want. Instead, firms will invest more when there are more cash flows. We look at the cash flows in each quarter to see whether the high capital expenditures in later quarters are due to greater cash flows in those quarters. We define cash flow as the sum of net income and depreciation.[12] In contrast to one's conjecture, the median cash flows are about 2.3% of total assets and do not increase towards the fourth quarter. Fazzari and Petersen (1993) report that working-capital investment competes with fixed investment so that working capital investment has a negative coefficient in the fixed investment regression.[13] Their findings suggest that cash

[11] We consider that 10 or greater is an excess value for sales growth, market to book ratios and quarterly capital expenditures, and we exclude observations with excess values from the sample.

[12] We also used operating income before interest, tax and depreciation as an alternative cash flow measure. The findings are qualitatively the same as what is reported here.

[13] For a survey of recent corporate finance issues related to working capital, see Kim (2001, 1996, 1991, 1988).

Table 1
Descriptive statistics for the final sample for each quarter

		Real assets	Quarterly real sales	Quarterly capital expenditure	Quarterly cash flows	Quarterly cash holdings	Market to book ratio	Quarterly sales growth
All quarters	Mean	1385.41	349.87	0.0164	0.0149	0.1288	1.6342	0.1435
	Median	79.85	25.46	0.0117	0.0234	0.0584	1.2926	0.0794
	1st Quartile	22.27	6.47	0.0055	0.0081	0.0159	1.0286	− 0.0399
	3rd Quartile	381.25	124.67	0.0211	0.0365	0.1809	1.8294	0.2294
	Number of observations	69,675	69,675	69,955	69,955	69,955	69,955	69,955
1st Quarter	Mean	1440.31	352.87	0.0141[a]	0.0163[a]	0.1244[a]	1.6021[a]	0.1365[a]
	Median	79.52	23.96[a]	0.0101[a]	0.0216[a]	0.0556[a]	1.2688[a]	0.0746[a]
	1st Quartile	22.00	6.20	0.0046	0.0080	0.0148	1.0140	− 0.0446
	3rd Quartile	383.57	120.26	0.0181	0.0338	0.1746	1.7855	0.2232
	Number of observations	17,745	17,745	17,745	17,745	17,745	17,745	17,745
2nd Quarter	Mean	1357.70	347.24	0.0157[a]	0.0179[a]	0.1242[a]	1.6346	0.1390[a]
	Median	79.03[b]	25.23[c]	0.0114[a]	0.0242[a]	0.0542[a]	1.2933	0.0782[a]
	1st Quartile	22.16	6.52	0.0054	0.0104	0.0147	1.0362	− 0.0396
	3rd Quartile	374.69	123.73	0.0205	0.0371	0.1726	1.8253	0.2225
	Number of observations	17,640	17,640	17,640	17,640	17,640	17,640	17,640

3rd Quarter	Mean	1342.19	334.93	0.0157[a]	0.0169[a]	0.1278[a]	1.6490	0.1447[c]
	Median	79.00[c]	25.59[a]	0.0113[a]	0.0239[a]	0.0570[a]	1.3031	0.0804
	1st Quartile	22.11	6.35	0.0053	0.0095	0.0151	1.0356	− 0.0373
	3rd Quartile	371.37	122.58	0.0204	0.0367	0.1802	1.8480	0.2322
	Number of observations	17,280	17,280	17,323	17,323	17,323	17,323	17,323
4th Quarter	Mean	1400.76	364.63	0.0201	0.0084	0.1389	1.6518	0.1542
	Median	81.73	27.38	0.0144	0.0239	0.0679	1.3101	0.0852
	1st Quartile	22.91	6.84	0.0070	0.0025	0.0193	1.0299	− 0.0384
	3rd Quartile	392.67	130.92	0.0259	0.0383	0.1964	1.8601	0.2394
	Number of observations	17,010	17,010	17,247	17,247	17,247	17,247	17,247

The sample is obtained from Quarterly Compustat tapes for manufacturing companies between 1984 and 1994. Observations with any missing or excess values were deleted from the sample and all variables are winsorized at the 1% tails. The final sample consists of 69,955 firm-quarter observations. Real assets and real sales are normalized to 1994 dollars using the "Monthly Consumer Price Index for all Urban" of the Bureau of Labor Statistics. Capital expenditure (Compustat quarterly data item number 90) and other variables are normalized by total assets (44). Cash flow is the sum of net income (69) and the depreciation (5). Cash holdings are the cash and short-term investments (36). Market to book ratio is the ratio of the sum of market value of equity (closing price (14) times shares outstanding (61)) and total book assets (44) minus book value of equity (59) to the book value of assets (44). Market to book ratio is the measure of growth opportunities at the beginning of the quarter. Sales growth is the change in sales from the same quarter of the previous fiscal year.

[a] Indicates that the difference from the fourth quarter is significant at the 1% level.

[b] Indicates that the difference from the fourth quarter is significant at the 5% level.

[c] Indicates that the difference from the fourth quarter is significant at the 10% level.

holdings at the end of the fourth quarter should be lower than that in other quarters. However, Table 1 shows that the fourth quarter cash holdings are higher than those of the other quarters. Since we observe large capital expenditures in the fourth quarter, a logical question is whether there are more growth opportunities in the fourth quarter than in other quarters. We measure investment opportunities at the beginning of the quarter using the ratio of the market value of the firm relative to the book value of the firm. The market value of the firm is the sum of market value of equity and total book assets minus book value of equity. The mean and median market to book ratios are about 1.6 and 1.3, respectively. However, we do not find any significant increase in growth opportunities in the fourth quarter, when a significant increase in capital expenditures is observed.

Sales growth is defined as changes in sales from the same quarter of the previous year. We observe a significant increase in sales growth in the fourth quarter compared with other quarters. This suggests that we need to control for the effect of sales growth to explain the effect of cash holdings and firm size on capital expenditure.

4. Quarterly capital investment and agency costs

4.1. Quarterly capital expenditures in the fixed investment equation

In the previous section, we show that the fourth quarter capital expenditures are greater than those of other quarters. In this section, we investigate whether a large investment in the fourth quarter is found even after we control for business fixed investment determinants.

In order to accomplish this controlling, we employ the Tobin's q investment model. The Tobin's q investment model suggests that a value-maximizing firm will invest as long as the market value of the firm is greater than the book value of the firm. This Tobin's q proxies the investment opportunities the market observes. Fazzari et al. (1988) examine the existence of financial constraints for non-dividend paying firms using a reduced form of the investment equation. Hoshi et al. (1991) also use the same model to determine whether Japanese independent firms are more financially constrained than keiretsu (group) member firms. In the investment model they used, the effect of cash flow on expectations of future demand is assumed to be captured by Tobin's q. However, Kaplan and Zingales (1997) report that the investment sensitivity to cash flow is not higher for financially constrained firms. Their findings raise a doubt about the interpretation of the coefficient of cash flows in the investment regression. Cummins et al. (1999), Gomes (in press), Erickson and Whited (2000), and Whited (in press) also provide evidence that investment-cash flow sensitivity cannot be monotonically related with degrees of financing constraints. Following the spirit of these research, we use cash flows as one of the determinants of investment rather than as a medium to capture the financial constraint. We also add sales growth to capture investment induced by increase in sales. The sales accelerator model does not have a theoretical background but is a widely accepted explanation for business-fixed investment. Since sales growth and capital expenditures are higher in the fourth quarter than in other quarters as we report in Table 1, we need to control for the effect of

sales growth on capital expenditures. Therefore, we combine the Tobin's q and sales accelerator models following Shin and Stulz (1998) and Shin and Park (1999).

Another explanation for our findings is that firms tend to have more cash flow in the last quarter of the calendar year so that financially constrained firms wait until the last quarter of the year and then invest. Since there are more sales and cash flows towards the end of the year because of special holidays such as Halloween, Thanksgiving and Christmas, firms may have more cash to spend and initiate additional projects in the fourth quarter. This financing argument is less appealing since there are many ways to raise short-term funds including bridging funds and credit lines. Nevertheless, we control for the effect of calendar quarters by including calendar quarter dummies in the regression. Calendar quarter dummies reduce the effect of seasonal pattern on the capital expenditures. Since the observations are not independent within years, we use Fama and Macbeth (1973) regression approach. That is, we run investment regression model each year for 11 years and report the mean and significance of 11 coefficients for each explanatory variables.[14]

Panel A of Table 2 presents results for two investment regressions. We show that the fourth quarter capital expenditures are significantly larger than those of other quarters even after controlling for standard investment determinants in the first regression where investment determinants are cash flows, Tobin's q and sales growth. The coefficients of the first, second, and third quarter dummy variables are significantly different from the coefficient of the fourth quarter dummy. In the second regression, we add changes in cash holdings to the regression. Fazzari and Petersen (1993) argue that if working capital investment competes with fixed asset investment, previous research underestimates the significance of financial constraints faced by firms. Consistent with their argument, they report that the coefficient of working capital investment is negative and significant in the fixed-asset investment regression. Similar to their method, but to avoid discretionary accrual problem, we add changes in cash holdings to the standard investment regression.[15] If firms use cash holdings as an investment alternative to capital expenditures, cash holdings will be higher when capital expenditures are lower, while cash holdings will be lower when capital expenditures are higher.[16] Therefore, the coefficient of changes in cash holdings will be negative in the investment regression. Furthermore, controlling the effect of changes in cash holdings on investment will help reveal the effect of changes in cash holdings on investment without invoking working capital adjustment problem. Panel B of Table 2 reports results of investment regressions with changes in cash holdings as an additional variable. As expected

[14] We also ran time-series cross-sectional regressions with year dummies in a previous version of the paper and found qualitatively the same result.

[15] Teoh et al. (1998a,b) and Rangan (1998) report a relation between earnings management and stock price performance after equity offerings. Their findings suggest that some companies might use accruals to manipulate their accounting report. Since net working capital is more prone to manipulation, we use cash holdings to measure competition between working capital investment and fixed capital investment.

[16] Brealey and Myers (2000) identify the issue of liquidity as one of the vexing corporate finance problems that are ripe for productive research. In equilibrium, the marginal value of additional liquidity must equal its marginal cost. However, the marginal value of corporate cash holdings declines with the size of cash holdings. Furthermore, we do not have a theory of liquidity to explain how the firm should divide its total investment between relatively liquid and relatively illiquid assets, not to mention the question of how much cash the firm should hold.

Table 2
Quarterly investment differences after controlling for investment determinants

	Without cash holdings change	With cash holdings change
	Coefficient (*t*-stat)	Coefficient (*t*-stat)
Panel A		
Cash flows	0.0606 (13.02)	0.0638 (13.01)
Changes in cash holdings		− 0.0204 (− 5.97)
Tobin's *q*	0.0021 (10.92)	0.0020 (11.78)
Sales growth	0.0022 (7.38)	0.0020 (7.10)
1st Quarter dummy	0.0094 (33.60)[a]	0.0092 (34.24)[a]
2nd Quarter dummy	0.0109 (38.51)[a]	0.0108 (39.26)[a]
3rd Quarter dummy	0.0110 (41.95)[a]	0.0111 (41.46)[a]
4th Quarter dummy	0.0157 (20.77)	0.0159 (20.28)
Panel B		
Cash flows	0.0969 (13.52)	0.1012 (13.20)
Changes in cash holdings		− 0.0219 (− 5.95)
Tobin's *q*	0.0047 (21.01)	0.0045 (22.98)
Sales growth	0.0019 (5.06)	0.0016 (4.63)
4th Quarter dummy	0.0102 (15.65)	0.0104 (15.74)
Cash flows × 4th quarter dummy	− 0.0513 (− 13.83)	− 0.0534 (− 12.74)
Tobin's *q* × 4th quarter dummy	− 0.0020 (− 6.26)	− 0.0019 (− 6.24)

The final sample consists of 69,955 firm-quarter observations. Capital expenditure (Compustat quarterly data item number 90) and other variables are normalized by total assets (44) at the beginning of each quarter. Cash flow is the sum of net income (69) and depreciation (5). Cash holdings are cash and short-term investments (36). Market to book ratio is the ratio of the sum of market value of equity (closing price (14) times shares outstanding (61)) and total book assets (44) minus book value of equity (59) to the book value of assets (44). Sales growth is the change in sales from the same quarter of the previous fiscal year. In Panel A, the quarterly capital expenditures are regressed on cash flows, Tobin's *q*, sales growth, and quarter dummies. The second regression includes changes in cash holdings as an additional variable. Calendar quarter dummies are included although the coefficients are not reported. *t*-statistics are shown in parenthesis.

[a] Indicates that the coefficient is significantly different from the fourth quarter coefficient at the 1% level.

from the results of Fazzari and Petersen (1993), we find significant negative coefficients for the changes in cash holdings in the second regression in Panel A of Table 2.

In Table 1, we observe that capital expenditures increase monotonically towards the fiscal year-end. We test this phenomenon in the regression, controlling for cash flows, changes in cash holdings, growth opportunities and sales growth. Gertner et al. (1999) examine the investment sensitivity to investment opportunities measured by Tobin's *q* for spinoffs before and after the spinoff. They report that investment is relatively insensitive to investment opportunities prior to the spinoff but becomes more sensitive after the spinoff. We adopt the same methodology to test the efficiency of quarterly investment in relation to various measures of agency costs. We add only the fourth quarter dummy to the standard investment equation in order to capture the size of investment in the fourth quarter that is not explained by standard investment determinants. Interactive terms such as cash flows times fourth quarter dummy and Tobin's *q* times fourth quarter dummy measure the effect of cash flows on the fourth quarter investment and efficiency of fourth quarter investment. The coefficient of the fourth quarter dummy is positive and significant, indicating that the

fourth quarter investment is significantly larger than other quarters, which was also shown in the Panel A of Table 2. The coefficient of the interactive term of cash flow and the fourth quarter dummy is negative and significant. This is inconsistent with the view that the large investment in the fourth quarter is driven by large cash flows in that quarter. One of the questions we really want to answer is whether the larger fourth quarter capital expenditure is justified by larger investment opportunities. The interactive term of Tobin's q and the fourth quarter dummy is negative and significant. This means that the fourth quarter investment is significantly less sensitive to investment opportunities.

4.2. Agency costs of cash holdings, firm size and diversification

In the previous section, we reported that the fourth quarter investment is unusually higher than other quarters as well as less efficient than other quarters. Next, we examine whether the investment in the fourth quarter is driven by factors other than investment opportunities or financial constraints. Does the level of cash holdings affect the firms' investment decision?

There are various explanations for corporate cash holdings. Miller and Orr (1966) argue that insufficient liquidity results in inefficient investment. Vogel and Maddala (1967) use transaction costs of raising external capital to explain the motivation for cash holdings. Moreover, Baskin (1987) emphasizes the strategic role of cash while John (1993) argues that firms with high costs of financial distress hold more cash. The literature generally suggests positive aspects of corporate cash holdings, ignoring the negative aspects of excess cash holdings. However, Jensen (1986) and Stulz (1990) argue that cash-rich firms may over-invest. Consistent with their theory, Harford (1997) finds that cash rich firms make more diversifying acquisitions that would lower shareholders' wealth.

Recent studies by Kim et al. (1998) and Opler et al. (1999) use a tradeoff between the costs and benefits of cash holdings to search for an optimal cash-holding level for corporations. Kim et al. (1998) predict that firms facing higher costs of raising capital, good investment opportunities, higher volatility of cash flows, and/or lower return on assets hold more cash. Similarly, Opler et al. (1999) report that firms with high growth opportunities and/or variable cash flows hold more cash, but firms with easy access to the capital market hold less cash. They also report that firms performing well tend to accumulate more cash than the static model predicts. Nevertheless, although Jensen's (1986) free-cash flow hypothesis suggests that firms with excess cash would invest more than they should, Opler et al. (1999) find little evidence that firms with excess cash invest more.

In this paper, we examine whether high cash-holding firms invest more than low cash-holding firms. Opler et al. (1999) report that the companies with the largest ratios of liquid assets to total assets are also the companies with the largest ratios of excess cash to assets. Therefore, we use raw cash holdings at the beginning of the quarter to divide samples into high and low cash firms. At the same time, we look at the sensitivity of investment to growth opportunities depending on the level of cash holdings at the beginning of the quarter. The cash dummy takes a value of 1 if a firm's cash holdings at the beginning of the quarter are above the median cash holdings of all firms at the beginning of the quarter. Otherwise, it takes a value of 0. We develop an interactive dummy variable to measure the

effect of growth opportunities on capital expenditures depending on the level of cash holdings at the beginning of the quarter.

Panel A of Table 3 presents the quarterly regression results for the investment equation with a cash holdings dummy and an interactive term of Tobin's q and cash holdings dummy. The coefficient of the cash dummy is positive and significant for all quarters, while the coefficient of the interactive term is negative and significant for all quarters. The positive coefficient of the cash dummy indicates that firms invest more when they have more cash or cash-equivalent investments.[17] However, the negative coefficient of the interactive cash dummy implies that large cash holdings reduce investment sensitivity to growth opportunities. If we believe that the investment decision is efficient when investment is determined by growth opportunities, investment decisions of high cash-holding firms are less efficient than those of low cash-holding firms. Panel B of Table 3 adds more interactive terms to the investment regression. These interactive terms are included to investigate whether less efficient investment occurs more often in the fourth quarter.

We confirm again that fourth quarter investment is significantly larger than other quarters, and this is true even after controlling for the level of cash holdings at the beginning of the quarter. The coefficient of the interactive term of Tobin's q and cash holdings is negative and significant, suggesting that the sensitivity of investment to Tobin's q is lower for the high cash firms. Furthermore, the coefficient of the interactive term of Tobin's q, cash dummy, and fourth quarter dummy is negative and significant, which means that the fourth quarter investment is less efficient with large cash holdings at the beginning of the quarter. This finding is consistent with the view that firms may use capital expenditures to store extra cash for future needs. It suggests that shareholders should pay more attention to the level of cash and cash-equivalent securities a firm holds since firms with higher level of cash tend to invest less efficiently. Audits of the fourth quarter investment activity should therefore be conducted more carefully.

Although we do not report the results in tables, we also used the payout ratio as a measure of financial constraint following Fazzari et al. (1988) and Hubbard and Palia (1998). The payout dummy variable equals one when the firm's payout ratio before the quarter is greater than the median payout ratio of all sample firms before the quarter. The payout ratio before the quarter is the ratio of the sum of the previous four quarters' dividend payments to the common stockholders to the sum of the previous four quarters' net income. Consistent with the cash holding results, firms with high payout ratios invest significantly more than firms with low payout ratios.

Finally, we examine the quarterly capital expenditure when firms have soft rationing. We argue that managers invest more in the fourth quarter to ensure the size of their budget for the next fiscal year. The "socialism" hypothesis of Scharfstein and Stein (1996) in capital budgeting is that headquarters gives more resources to under-performing divisions to reduce its managers' perk-seeking activities. This hypothesis implies that divisional

[17] If managers believe that outsiders view large cash holdings as negative NPV projects and discount the managers' ability by the level of cash holdings, managers with excess cash may want to reduce their cash holdings by investing more.

Table 3
Quarterly investment regressions with cash holdings dummy and Tobin's q–cash holdings interactive term

Panel A

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
	Coefficient (t-stat)	Coefficient (t-stat)	Coefficient (t-stat)	Coefficient (t-stat)
Cash flows	0.0957 (9.97)	0.0866 (11.55)	0.0804 (13.46)	0.0504 (9.50)
Changes in cash holdings	− 0.0202 (− 5.54)	− 0.0222 (− 4.73)	− 0.0280 (− 4.33)	− 0.0308 (− 5.70)
Tobin's q	0.0075 (27.89)	0.0067 (19.03)	0.0068 (30.99)	0.0090 (9.25)
Sales growth	0.0013 (4.70)	0.0018 (5.08)	0.0018 (3.99)	0.0021 (4.13)
Cash holdings dummy	0.0084 (34.11)	0.0077 (19.03)	0.0074 (19.11)	0.0088 (11.69)
Tobin's $q \times$ cash holdings dummy	− 0.0059 (− 22.11)	− 0.0051 (− 14.52)	− 0.0050 (− 20.05)	− 0.0068 (− 8.96)

Panel B

	All quarters
	Coefficient (t-stat)
Cash flows	0.0696 (12.14)
Changes in cash holdings	− 0.0242 (− 6.13)
Tobin's q	0.0071 (27.67)
Sales growth	0.0019 (6.01)
Cash holdings dummy	0.0075 (34.42)
4th Quarter dummy	0.0066 (8.84)
Tobin's $q \times$ cash holdings dummy	− 0.0053 (− 29.62)
Tobin's $q \times$ cash holdings dummy $\times$ 4th quarter dummy	− 0.0005 (− 3.93)

The final sample consists of 69,955 firm-quarter observations. Capital expenditure (Compustat quarterly data item number 90) and other variables are normalized by total assets (44) at the beginning of each quarter. Cash flow is the sum of net income (69) and depreciation (5). Cash holdings are cash and short-term investments (36). Market to book ratio is the ratio of the sum of market value of equity (closing price (14) times shares outstanding (61)) and total book assets (44) minus book value of equity (59) to the book value of assets (44). Sales growth is the change in sales from the same quarter of the previous fiscal year. In Panel A, the quarterly capital expenditures are regressed on cash flows, changes in cash holdings, Tobin's q, sales growth, cash holdings dummy, and Tobin's q and cash holdings interactive dummy. The cash holdings dummy takes a value of 1 if cash holding at the beginning of the quarter is above the median level. Otherwise, it takes a value of 0. The interactive dummy is the cash holdings dummy times the Tobin's q. In Panel B, the fourth quarter dummy and interactive term between cash holdings dummy, fourth quarter dummy and Tobin's q are added to the regression. Calendar quarter dummies are included although the coefficients are not reported. t-statistics are shown in parenthesis.

managers facing soft-rationing would more likely use up their planned budget by the end of the fiscal year. Furthermore, for some firms, headquarters may allow such abnormal divisional capital expenditures in the fourth quarter. The socialism in capital budgeting would be more serious in large firms since the headquarters' monitoring of divisional managers' activities would be less efficient. However, small firms facing hard-rationing will try to invest more efficiently than firms facing soft-rationing.[18] Therefore, we expect greater quarterly variations in capital expenditures for large firms than for small firms. Assuming that large firms have more divisions than small firms, and large-firm divisional managers have soft-rationing problems while small-firm managers have hard-rationing problems, over-investment in the fourth quarter would be more evident for large firms than for small firms. In order to construct sub-samples by firm size, we first divide the sample firms into four quartiles using total assets. Since the size distribution is skewed to the right, as shown in the mean and median comparison, we call the top first quartile the large firms and other quartiles small firms. This classification ensures that we have truly large firms in the large firm group.

We first compare the size-adjusted capital expenditures between large firms and small firms. Even though we do not report in a table, we find that large firms invest significantly more than small firms in all quarters. We compare increases in capital expenditure from the first to the fourth quarter between small firms and large firms. Consistent with our argument, we find that large firms invest relatively more in the fourth quarter and their variation is significantly larger than small firms' variation. Using the regression, we examine whether this relation holds after controlling for investment determinants. We ran a regression of capital expenditures on cash flow, cash holdings, Tobin's q, sales growth, size dummy and interactive term of Tobin's q and size dummy for each quarter. The size dummy takes a value of 1 if the firm's assets are in the top first quartile of the sample in the given quarter. The Tobin's q-size interactive dummy is Tobin's q times size dummy. The coefficient of the size dummy is positive but the interactive term in Table 4 is negative and significant, suggesting that capital expenditures are greater for large firms than small firms and large-firm capital expenditures are less efficient than small-firm capital expenditures.

Lastly, we examine the quarterly capital expenditures of diversified firms. There is a growing amount of literature reporting inefficient capital allocation within diversified firms. Among many papers, Shin and Stulz (1998) report that, within a diversified firm, divisional investment is less related to its own growth opportunities than other divisions' cash flows. We use segment data used by Shin and Stulz (1998) to define diversified and stand-alone firms. Firms with two or more segments are defined as diversified firms and firms with only one segment are defined as stand-alone firms. We find, even though we do not report in a table, that diversified firms invest significantly more than single segment firms in the univariate analysis. Panel A of Table 5 shows the result of investment regressions with diversification dummy and interactive term of Tobin's q and diversification dummy. The positive coefficient of the diversification dummy indicates that diversified firms invest more than stand-alone firms, even after controlling for other

[18] Lamont et al. (1998) sort firms independently by both size and the Kaplan and Zingales (1997) constraint index, and find that small firms are disproportionately constrained by constraint measures and constrained firms are disproportionately small.

Table 4
Quarterly investment regressions with size dummy and Tobin's q–size interactive term

Panel A

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
	Coefficient (t-stat)	Coefficient (t-stat)	Coefficient (t-stat)	Coefficient (t-stat)
Cash flows	0.1067 (10.81)	0.0918 (11.58)	0.0836 (15.80)	0.0466 (9.30)
Changes in cash holdings	− 0.0203 (− 5.78)	− 0.0187 (− 4.44)	− 0.0252 (− 4.36)	− 0.0241 (− 5.81)
Tobin's q	0.0047 (32.20)	0.0040 (14.29)	0.0042 (17.35)	0.0048 (8.84)
Sales growth	0.0012 (3.29)	0.0019 (5.14)	0.0018 (3.92)	0.0022 (4.85)
Size dummy	0.0091 (12.99)	0.0050 (6.42)	0.0071 (11.49)	0.0068 (6.90)
Tobin's $q \times$ size dummy	− 0.0030 (− 7.20)	− 0.0013 (− 2.41)	− 0.0023 (− 7.24)	− 0.0013 (− 1.93)

Panel B

	All quarters
	Coefficient (t-stat)
Cash flows	0.0717 (12.95)
Changes in cash holdings	− 0.0217 (− 6.14)
Tobin's q	0.0043 (19.87)
Sales growth	0.0019 (5.72)
Size dummy	0.0070 (10.81)
4th Quarter dummy	0.0068 (9.09)
Tobin's $q \times$ size dummy	− 0.0016 (− 4.01)
Tobin's $q \times$ size dummy $\times$ 4th quarter dummy	− 0.0007 (− 4.41)

The final sample consists of 69,955 firm-quarter observations. Capital expenditure (Compustat quarterly data item number 90) and other variables are normalized by total assets (44) at the beginning of each quarter. Cash flow is the sum of net income (69) and depreciation (5). Cash holdings are cash and short-term investments (36). Market to book ratio is the ratio of the sum of market value of equity (closing price (14) times shares outstanding (61)) and total book assets (44) minus book value of equity (59) to the book value of assets (44). Sales growth is the change in sales from the same quarter of the previous fiscal year. In Panel A, the quarterly capital expenditures are regressed on cash flows, changes in cash holdings, Tobin's q, sales growth, quarter dummies and size–fourth quarter interactive dummy. Size dummy takes the value of 1 if firm size measure by assets at the beginning of the quarter is above the third quartile. Otherwise, it takes the value of 0. The interactive dummy is the size dummy times the fourth quarter dummy. In Panel B, the fourth quarter dummy and interactive term between size dummy, fourth quarter dummy and Tobin's q are added to the regression. Calendar quarter dummies are included although the coefficients are not reported. t-statistics are shown in parenthesis.

Table 5
Quarterly investment regressions with diversification dummy and Tobin's q–diversification interactive term

Panel A

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
	Coefficient (t-stat)	Coefficient (t-stat)	Coefficient (t-stat)	Coefficient (t-stat)
Cash flows	0.1117 (10.66)	0.0971 (11.37)	0.0855 (15.90)	0.0512 (10.09)
Changes in cash holdings	− 0.0176 (− 4.26)	− 0.0197 (− 4.11)	− 0.0268 (− 4.49)	− 0.0247 (− 5.16)
Tobin's q	0.0049 (28.12)	0.0043 (13.38)	0.0043 (20.19)	0.0048 (8.11)
Sales growth	0.0015 (3.97)	0.0020 (6.31)	0.0019 (3.88)	0.0022 (4.18)
Diversification dummy	0.0073 (12.45)	0.0059 (10.59)	0.0058 (8.39)	0.0034 (3.23)
Tobin's $q \times$ diversification dummy	− 0.0030 (− 6.68)	− 0.0030 (− 9.44)	− 0.0025 (− 6.41)	− 0.0013 (− 2.04)

Panel B

	All quarters
	Coefficient (t-stat)
Cash flows	0.0759 (13.14)
Changes in cash holdings	− 0.0215 (− 5.65)
Tobin's q	0.0045 (20.81)
Sales growth	0.0020 (6.09)
Diversification dummy	0.0058 (9.09)
4th Quarter dummy	0.0069 (8.57)
Tobin's $q \times$ diversification dummy	− 0.0021 (− 5.45)
Tobin's $q \times$ diversification dummy $\times$ 4th quarter dummy	− 0.0012 (− 4.72)

Capital expenditure (Compustat quarterly data item number 90) and other variables are normalized by total assets (44) at the beginning of each quarter. Cash flow is the sum of net income (69) and depreciation (5). Cash holdings are cash and short-term investments (36). Market to book ratio is the ratio of the sum of market value of equity (closing price (14) times shares outstanding (61)) and total book assets (44) minus book value of equity (59) to the book value of assets (44). Sales growth is the change in sales from the same quarter of the previous fiscal year. In Panel A, the quarterly capital expenditures are regressed on cash flows, changes in cash holdings, Tobin's q, sales growth, quarter dummies, the diversification dummy and the diversification–fourth quarter interactive dummy. The diversification dummy takes the value of 1 if a firm has two or more segments. Otherwise, it takes the value of 0. In Panel B, the fourth quarter dummy and interactive term between diversification dummy, fourth quarter dummy and Tobin's q are added to the regression. Calendar quarter dummies are included although the coefficients are not reported. t-statistics are shown in parenthesis.

investment determinants. The coefficient of the interactive term is negative, consistent with the view that diversified firms make less-efficient allocation of internal capital, so their investment is less sensitive to the investment opportunities.

Panel B of Table 5 includes two more variables to investigate the investment efficiency in the fourth quarter for diversified firms. As we expected, the coefficient of the interactive term of Tobin's q, diversification dummy and the fourth quarter dummy is negative and significant, suggesting that the fourth quarter investment tends to be less efficient for diversified firms than stand-alone firms.

4.3. Discussion of alternative explanations

Some may argue that our findings are due to earnings management. Das and Shroff (1998) provide evidence that companies frequently manage earnings by adjusting fiscal year-end accruals to achieve a desired level of annual earnings. They find that 35% of their sample firms exhibit earnings reversals in the fourth quarter, that is, firms report positive (negative) earnings changes in the fourth quarter following negative (positive) earnings changes in interim quarters. Our findings look similar to the consequence of earnings management. However, we find only positive changes in capital expenditures from interim quarters to the fourth quarter, while Das and Shroff (1998) find changes in both directions. In order for our findings to be a result of earnings or accrual management, the fourth quarter capital expenditures should not exhibit only one-sided change.

Since we find that the fourth quarter over investment is more evident for larger firms than smaller firms, if this is a result of earnings management, we should find more earnings management for larger firms than smaller firms. Gu and Lee (1999) examine intra-year earnings management of large and small firms. They find that large firms manage earnings less than small firms. This is contradictory evidence that earnings management makes the fourth quarter capital expenditure look higher than other quarters.

Some may still argue that if capital expenditures are used to increase depreciation (so as to decrease earnings), but other methods are used to increase earnings, then only positive changes in capital expenditures are found from the interim quarters to the fourth quarter. However, these explanations based on accounting practice cannot explain the relation between agency cost proxies (cash holdings, firm size, and diversification) and the fourth quarter capital investments.

5. Summary and conclusion

We find larger capital expenditures in the fourth quarter. We propose agency theory to explain the phenomenon and then document that investments by firms with large cash holdings are less responsive to their growth opportunities than investments by firms with little cash holdings. We also report that, after adjusting for size differences, large firms invest more than small firms and this difference is even greater in the fourth quarter. In addition, we show that diversified firms invest more but less efficiently than stand-alone firms in all quarters, and this is more pronounced in the fourth quarter. To the extent that cash holdings proxy for free cash flows, and that firm size and diversification proxy for

inefficient allocation of internal capital, the findings are consistent with the agency hypothesis that corporate investment decisions are affected by the agency costs of the firm. Overall, we find a support for the idea that quarterly capital expenditures are inefficiently allocated and the degree of inefficiency is explained by agency costs. Our main empirical contribution to the literature is to demonstrate that agency costs do affect the efficiency of quarterly investment behavior of the firm.

Corporate policy implications may emerge from the findings of this paper. First, firms might need to develop new policy guidelines to keep managers from being forced to spend the surplus of the initially allocated budget towards the end of the fiscal year. Perhaps, this objective can be achieved by not using current year's expenditure as a benchmark for the following year's budget allocation, and by allowing the carryover of unused budgets to the following fiscal year. Harris and Raviv (1998) show that rollovers are always optimal when projects are arriving sequentially and audit costs are high. We argue that managers who find out more about the feasibility of the sequential projects as time passes, but cannot rollover the budget to the next period, would spend the budget before it expires.

Second, shareholders and boards of directors may need to pay more attention to the capital expenditures in the fiscal fourth quarter, since these expenditures are significantly influenced by factors other than investment opportunities and are less likely to represent efficient uses of the firm's capital.

Acknowledgements

We thank anonymous referees, the editor (Ken Lehn), Mike Ferguson, Brian Hatch, Shane Johnson, Sandip Mukherji, Stephen Peters, and Steve Wyatt for their helpful comments and discussions, Bill Banks and Olivier Maisondieu LaForge for their excellent research assistance, and the participants in the 1999 Financial Management Association Meeting, the 1999 Joint Meeting of the Korea–America Finance Association and the Allied Korean Associations for Financial Studies, and the finance workshops at SUNY–Buffalo and University of Cincinnati for helpful comments. Shin is grateful to PDQWL of the UB for financial support through the Individual Development Awards Program. Kim thanks the George Scull Fund of the University of Cincinnati Foundation for financial support.

References

Bartov, E., 1993. The timing of asset sales and earnings manipulation. The Accounting Review 68, 840–855.

Baskin, J., 1987. Corporate liquidity in games of monopoly power. Review of Economics and Statistics 69, 312–319.

Berkovitch, E., Israel, R., 1998. Why the NPV criterion does not maximize NPV, Working paper, The University of Michigan.

Brealey, R.A., Myers, S.C., 2000. Principles of Corporate Finance, 6th edn. McGraw-Hill, Boston, MA.

Callen, J.L., Livnat, J., Ryan, P.G., 1996. Capital expenditures: value-relevance and fourth-quarter effects. Journal of Financial Statement Analysis 1 (3), 13–24.

Cummins, J.G., Hassett, K.A., Oliner, S.D., 1999. Investment behavior, observable expectations, internal funds, Manuscript, New York University.

Das, S., Shroff, P.K., 1988. Fourth quarter reversals in earnings changes: motivations and consequences, Working paper, University of Illinois at Chicago.

Erickson, T., Whited, T.M., 2000. Measurement error and the relationship between investment and q. Journal of Political Economy 108, 1027–1057.

Fama, E.F., French, K.R., 1998. Taxes, financing decisions, and firm value. Journal of Finance 53, 819–844.

Fama, E.F., MacBeth, J.D., 1973. Risk, return, and equilibrium: empirical tests. Journal of Political Economy 81, 607–636.

Fazzari, S.M., Petersen, B.C., 1993. Working capital and fixed investment: new evidence on financing constraints. Rand Journal of Economics 23, 328–342.

Fazzari, S.M., Hubbard, R.G., Petersen, B., 1988. Financing constraints and corporate investment. Brookings Papers on Economic Activity 19, 141–195.

Gertner, R., Powers, E., Scharfstein, D., 1999. Learning about internal capital markets from corporate spinoffs, Working paper, Massachusetts Institute of Technology.

Gomes, J., 2001. Financing investment. In press American Economic Review.

Gu, Z., Lee, C.J., 1999. How Widespread Is Earnings Management? The Intra-Year Timing Evidence, Working paper, Carnegie Mellon University.

Harford, J., 1997. Corporate cash reserves and acquisitions, Unpublished working paper, William E. Simon Graduate School of Business Administration, University of Rochester, Rochester, NY 14627.

Harris, M., Raviv, A., 1996. The capital budgeting process: incentives and information. Journal of Finance 51, 1139–1174.

Harris, M., Raviv, A., 1998. Capital budgeting and delegation. Journal of Financial Economics 50, 259–289.

Hoshi, T., Kashyap, A., Scharfstein, D., 1991. Corporate structure liquidity, and investment: evidence from Japanese industrial groups. Quarterly Journal of Economics, 33–59.

Hubbard, R.G., 1998. Capital-market imperfections and investment. Journal of Economic Literature 36, 193–225.

Hubbard, R.G., Palia, D., 1998. A re-examination of the conglomerate merger wave in the 1960s: an internal capital markets view. Journal of Finance 54, 1131–1152.

Jensen, M.C., 1986. Agency costs of free cash flow, corporate finance, and takeovers. American Economic Review 76, 323–329.

Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: managerial behavior, agency costs and ownership structure. Journal of Financial Economics 3, 305–360.

John, T.A., 1993. Accounting measures of corporate liquidity, leverage, and costs of financial distress. Financial Management 22, 91–100.

Kaplan, S.N., Zingales, L., 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? Quarterly Journal of Economics 112, 169–215.

Kim, Y.H., 1996, 1991, 1988. Advances in Working Capital Management. 1st, 2nd, 3rd vols. JAI Press, Greenwich, CT.

Kim, C., Mauer, D., Sherman, A., 1998. The determinants of corporate liquidity: theory and evidence. Journal of Financial and Quantitative Analysis 33, 335–359.

Kim, Y.H., 2001. Advances in Working Capital Management. 4th vol. JAI/Elsevier Science.

Kinney, M., Trezevant, R.H., 1993. Taxes and the timing of corporate capital expenditures. Journal of the American Taxation Association 15, 40–62.

Lamont, O., 1997. Cash flow and investment: evidence from internal capital markets. Journal of Finance 52, 83–110.

Lamont, O., Polk, C., Saá-Requejo, J., 1998. Financial constraints and stock returns, Working paper, University of Chicago.

Majd, S., Pyndyck, R., 1987. Time to build, option value, and investment decision. Journal of Financial Economics 18, 7–27.

Miller, M.H., Orr, D., 1966. A model of the demand for money by firms. Quarterly Journal of Economics, 413–435.

Myers, S.C., Majluf, N.S., 1984. Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics 13, 187–221.

Opler, T., Pinkowitz, L., Stulz, R., Williamson, R., 1999. The determinants and implications of corporate cash holdings. Journal of Financial Economics 52, 3–46.

Rajan, R., Servaes, H., Zingales, L., 1997. The cost of diversity: the diversification discount and inefficient investment, Working paper, University of Chicago.

Rangan, S., 1998. Earnings management and the performance of seasoned equity offerings. Journal of Financial Economics 50, 101–122.

Scharfstein, D., 1997. The dark side of internal capital markets II: evidence from diversified conglomerates, Working paper, MIT.

Scharfstein, D., Stein, J., 1996. The dark side of internal capital markets: divisional rent-seeking and inefficient investment, NBER working paper No. 5969.

Shin, H.H., Park, Y.S., 1999. Financing constraints and internal capital markets: evidence from Korean Chaebols. Journal of Corporate Finance 5, 169–191.

Shin, H.H., Stulz, R., 1998. Are internal capital markets efficient? Quarterly Journal of Economics 113, 531–552.

Stein, J.C., 1997. Internal capital markets and the competition for corporate resources. Journal of Finance 52, 111–134.

Stulz, R., 1990. Managerial discretion and optimal financing policies. Journal of Financial Economics 26, 3–27.

Taggart, R., 1987. Allocating capital among a firm's divisions: Hurdle rates vs. budgets. Journal of Financial Research 10, 177–190.

Teoh, S.H., Welch, I., Wong, T.J., 1998a. Earnings management and the underperformance of seasoned equity offerings. Journal of Financial Economics 50, 63–99.

Teoh, S.H., Welch, I., Wong, T.J., 1998b. Earnings management and the long-run market performance of initial public offerings. Journal of Finance 53, 1935–1974.

Vogel, R.C., Maddala, G.S., 1967. Cross-section estimates of liquid asset demand by manufacturing corporations. Journal of Finance 22, 557–575.

Whited, T.M., 2001. Is it inefficient investment that causes the diversification discount? In press Journal of Finance.