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Firm structure and corporate cash holdings

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ABSTRACT

We analyze whether the organizational structure of firms (i.e., whether a firm is diversified or focused) affects their cash holdings. Using Compustat firm level and segment-level data, we find that diversified firms hold significantly less cash than their focused counterparts. Our results are robust to industry adjustments at the segment level and to different factors previously found to be important determinants of cash holdings. Using time-series, cross-sectional, and additional robustness tests we are able to attribute the lower cash holdings among diversified firms to complementary growth opportunities across the different segments of these firms and the availability of active internal capital markets. We find that the other theories that rely on the potentially effective use of asset sales of non-core segments of diversified firms to generate cash, and the increased agency/influence costs in diversified firms do not offer an economically significant explanation for the lower cash holdings among diversified firms.

1. Introduction

Cash holding, an important asset on firms' balance sheets, receives much attention from companies, investors, and analysts. Cash becomes especially important in recessions. The credit crunch that started in late 2007 has had a massive and sustained impact on the way many companies operate throughout the world. Companies with sufficient cash on hand may escape the need to tap into the increasingly costly and restrictive credit markets. Determinants of cash holdings have long been debated in the finance literature. Potential explanations range from the tradeoff between the marginal costs and benefits of holding cash to corporate governance.[1] Our paper examines a previously ignored but important relationship between firm structure and cash holdings. We show that diversified firms hold significantly less cash than focused firms. The lower level of cash holdings among diversified firms can be attributed to their access to internal capital markets, greater potential for asset sales, and higher agency costs in diversified firms.

The investment opportunities of individual segments of diversified firms may be imperfectly correlated, which suggests a possible role for internal capital market in these firms (Lamont, 1997; Shin and Stulz, 1998; Khanna and Tice, 2001). If firms hold cash for potential growth opportunities as in Opler et al. (1999) and to react to the underinvestment problem arising from financing related predation risk in imperfect product markets as in Haushalter et al. (2007), the imperfect correlation mentioned

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[1] See for example, Meltzer (1963), Miller and Orr, (1966), Mulligan (1997), Opler et al. (1999), Harford et al. (2003), Dittmar et al. (2003), Kalcheva and Lins (2005), Pinkowitz et al. (2006), Haushalter et al. (2007), Foley et al. (2007), Acharya et al. (2007), D'Mello et al. (2008), Harford et al. (2008), and Denis and Sibilkov (2010).

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above implies that diversified firms would need less cash on hand to meet their investment demands at any one point in time. Also, the availability of cash flow from one segment as potential capital for another segment reduces diversified firms' need for external capital and further reduces their benefits of holding cash.

In addition, diversified firms are more likely to be able to raise funds by selling their assets than focused firms. Shleifer and Vishny (1992) describe asset sales as a source of financing. A firm with assets that can be cheaply converted into cash can raise funds at a low cost by selling these assets. Therefore, given the size and breadth of assets owned, diversified firms are more likely to raise funds by selling substantial assets, especially the non-core segments, than single-segment firms, which in turn reduces the need for cash holdings. Consequently, firms with more than one segment should have lower levels of cash holdings relative to focused firms.

Lastly, diversified firms may face more severe agency problems that arise from segment-managers' intent to compete for firm-wide resources (Rajan et al., 2000). Segments with more influence in the firm will receive more resources, which could lead to over-investment and other dead-weight costs (Milgrom and Roberts, 1990; Bagwell and Zechner, 1993). Therefore, the marginal costs of holding cash and liquid assets, which generate these agency costs, are higher for diversified firms than for focused firms.[2] As a result, we would again expect diversified firms to hold less cash than focused firms in order to mitigate these agency costs.

Using Compustat data for U.S firms in the1988 to 2006 period, this paper finds that diversified firms hold significantly less cash than focused firms. This difference in cash holdings remains significant even after controlling for industry at the segment level, and other important determinants of cash holdings found in the literature. In addition, our paper shows that the presence of growth opportunities that are imperfectly correlated across segments in the firm, the increased potential for asset sales (of non-core assets), and the higher agency costs among diversified firms are all statistically significantly related to their lower cash holdings. However, we also find that with additional robustness tests, the imperfect correlations in growth across segments and the cross-segment financing possibilities arising from internal capital markets emerge as the most consistent and economically significant explanations for the lower cash holdings among diversified firms.

Our paper contributes to the cash holdings and the firm structure literatures in different and significant ways. Opler et al. (1999) provide a fundamental framework to study determinants of cash holdings and find several influential factors that determine cash holdings, including corporate growth prospects, short-term working capital, leverage, industry volatility, and firm size. Subsequent literature highlights the costs and benefits of cash holdings related to corporate governance (e.g., Dittmar et al., 2003; Pinkowitz et al., 2006; Kalcheva and Lins, 2007; Harford et al., 2008 among others), the predation risk in imperfect product markets (Haushalter et al., 2007), financial constraints (Denis and Sibilkov, 2010), and the financing of corporate investments (e.g., Almeida et al., 2004). Dittmar et al. (2003) find that firms in countries with poor protection of shareholder rights hold twice as much cash as firms in countries with good protection of shareholder rights. They argue that the evidence is consistent with the view that investors in countries with poor shareholder protection are unable to force managers to pay out the excess cash.

In a related vein, Dittmar and Mahrt-Smith (2007) show that the value of cash is also much lower in poorly governed firms. They show that in poorly governed firms, cash is dissipated in ways that significantly reduce future operating performance. Similarly, Harford et al. (2008) find that in firms with high anti-takeover provisions (i.e., firms with poor shareholder rights), cash is dissipated through value-destroying acquisitions. Consistent with this evidence, Kalcheva and Lins (2007) find that when external country-level governance is weak, although there is no general discount in value of high cash balance firms, there is a valuation discount to high cash balance firms where the managers are also expected to be entrenched.[3]

Our first significant contribution is that we examine the importance of several, previously ignored, *non-governance* related factors in explaining corporate cash holdings. We focus on organizational structure of firms by taking into account the cross-segment correlations in investment opportunities, and agency and asset structure aspects that are unique to diversified firms. We find clear evidence that firm structure influences cash management strategy and a diversified firm structure lowers the optimal level of cash holdings. As Harford et al. (2008) argue, unlike in international data, where there is substantial variation in the protection of shareholder rights across countries, in the U.S., governance is fairly uniform. This lack of significant variation in governance regimes, especially between focused and diversified firms, provides us with an opportunity to isolate the relative importance of non-governance factors in determining cash holdings.

Second, this paper also contributes to the existing literature on firm structure—diversified versus focused firms, in two distinct ways. First, our paper complements the work in Harford et al. (2003), Haushalter et al. (2007), Acharya et al. (2007), and Denis and Sibilkov (2010) all of whom either directly or indirectly argue that cash acts as a hedge for firms against financing and predation risk, especially in downturns. We show that in this regard, a diversified firm structure in itself may be a natural hedge and may act as a substitute for cash holding. In addition, prior papers, including Berger and Ofek (1995), Lamont (1997), Shin and Stulz (1998), and Khanna and Tice (2001), study the effectiveness of internal capital markets within diversified firms. We extend previous work on the efficient allocation of firm resources from internal capital markets to include cash holdings. Our finding that firms with higher influence costs have less cash holdings indicates that conglomerates respond to the higher agency costs by reducing their cash holdings.

Third, this paper develops a methodology similar to that used in Berger and Ofek (1995) to control for the industry effects on cash holdings, while previous literature uses industry dummy variables to control for the industry effects. More specifically, we use

[2] Costs due to these principal–agent conflicts fall under the general rubric of influence costs in the corporate governance literature.

[3] Faulkender and Wang (2006) also analyze the value that market places on cash holdings and how it varies cross-sectionally. In particular, they find that the marginal value of cash declines with large cash holdings, higher leverage, better access to capital markets, and as firms choose to distribute cash via dividends rather than repurchases.

the median cash holdings in the industry of each division to calculate imputed cash holdings and then use adjusted cash holdings to measure the difference between diversified firms and focused firms. The measurement improvement is non-trivial because diversified firms by definition operate in more than one industry, and so the (primary) industry dummy variable cannot fully capture the industry effects and thereby leads to noisy estimates. By developing this methodology, we have a much improved proxy for industry effects.

The rest of this paper is organized as follows. Section 2 formally discusses the theoretical framework used in this paper. This is followed by a description of the data and empirical methodology in Section 3. Section 4 presents empirical analyses of the effects of firms' structure on their cash holdings. Section 5 reports results from various robustness checks, including different regression specifications and with alternate variables and proxies. Section 6 concludes.

2. Theoretical considerations

This paper follows the theoretical framework developed by Opler et al. (1999), which states that firms' optimal cash holdings are determined by the tradeoff between the marginal costs and benefits of holding liquid assets. The costs of holding cash include opportunity costs of idle capital and agency costs associated with managerial discretion, whereas the benefits of holding cash include avoiding unnecessary transactions to borrow money and alleviating information asymmetry and agency costs associated with external capital. Based on this simple intuition, we believe that firms' organizational structure could significantly affect their optimal cash holdings given there are different agency costs and financing needs associated with diversified and focused firms.

A multi-segment firm is not a simple combination of its segments. While segments are interdependent, their growth opportunities are likely to be imperfectly correlated (Lamont, 1997, Shin and Stulz, 1998; Khanna and Tice, 2001). Consequently, if firms hold cash for potential growth opportunities as argued in Opler et al. (1999), a diversified firm should need less cash to meet its investment demand than a focused firm at any given point in time. Enhancing this effect, a diversified firm could also cross finance one segment's investment projects with another segment's cash holdings. In short, complementary growth opportunities at the segment level in diversified firms along with the availability of internal capital markets in these firms reduce the marginal benefits of holding liquid assets. This suggests that diversified firms should hold less cash than focused firms. We call this the *complementary growth* hypothesis.

This hypothesis also has a connection to another thread in the cash holdings literature. Harford et al. (2003), Haushalter et al. (2007), Acharya et al. (2007) and Denis and Sibilkov (2010) all argue that cash acts as a hedge for firms against financing and predation risk, especially in downturns. The complementary growth hypothesis in effect examines whether the imperfect correlation in growth opportunities and cash flows across segments of a diversified firm act as natural hedge against the financing and predation risk discussed in the above papers, and whether a diversified firm structure may be a partial substitute for cash holdings in this context.

Diversified firms are also more likely to sell their assets to raise funds than focused firms. Shleifer and Vishny (1992) argue that firms should have lower borrowing costs if they have more assets that can be cheaply and easily converted into cash. Given that diversified firms are on average three times the size of focused firms, and they have assets from non-core segments, we expect diversified firms are more likely to raise funds by selling substantial assets, especially assets from non-core segments, than focused firms. This again reduces the marginal benefit of holding cash, which is a source of internal capital that does not incur the information asymmetry related costs associated with external financing. The greater likelihood of using asset sales as a financing channel suggests that diversified firms should have a lower need to hold cash. We refer to this as the *asset sales* hypothesis.

While the multi-segment firm structure does provide benefits, it can also give rise to severe agency costs. Rajan et al. (2000) show that diversified firms may face more severe agency problems that arise from segment-managers' propensity to lobby for firm-wide resources. Segments with more influence in the firm will garner more resources, which could potentially lead to an over-investment problem and other dead-weight costs (see Milgrom and Roberts, 1990; Bagwell and Zechner, 1993). As a result, the marginal costs of holding cash and liquid assets associated with these agency costs are higher for diversified firms than for focused firms. Therefore, we again would expect diversified firms to hold less cash than focused firms in order to alleviate these influence costs. We refer to this as the *influence costs* or *agency costs* hypothesis.

Fig. 1 illustrates how the optimal level of cash holdings can be affected by the firm structure via the three hypotheses. Fig. 1a shows a downward sloping marginal benefit curve of holding liquid assets and a horizontal marginal cost curve of holding liquid assets, which follows Opler et al.'s (1999) assumption that costs of holding cash arise mainly from idle capital. The equilibrium for the optimal cash holdings is the intersection of these two curves. According to our first two hypotheses, the marginal benefits of holding cash could differ across firm structures. Both the complementary growth and the asset sales hypotheses suggest that marginal benefits of holding cash are less for diversified firms than for focused firms. Consequently, diversified firms' marginal benefit curve of holding cash should be to the left of focused firms' marginal benefit curve, which suggests that the former has a lower optimal level of liquid assets than the latter. The influence cost hypothesis on the other hand focuses on the marginal costs of holding cash. Absent agency costs, there is no reason to believe that the marginal costs of holding cash are different for diversified and focused firms. If agency problems related to influence costs are higher for diversified firms, one would then expect the horizontal line representing the marginal costs of holding cash to move higher for diversified firms (as shown in Fig. 1b). Holding the marginal benefit curve constant, the shift in the marginal cost curve would cause the intersection between the marginal cost curve and marginal benefit curve for diversified firms to be to the left of the intersection for focused firms, which again predicts a lower level of cash holdings for diversified firms.

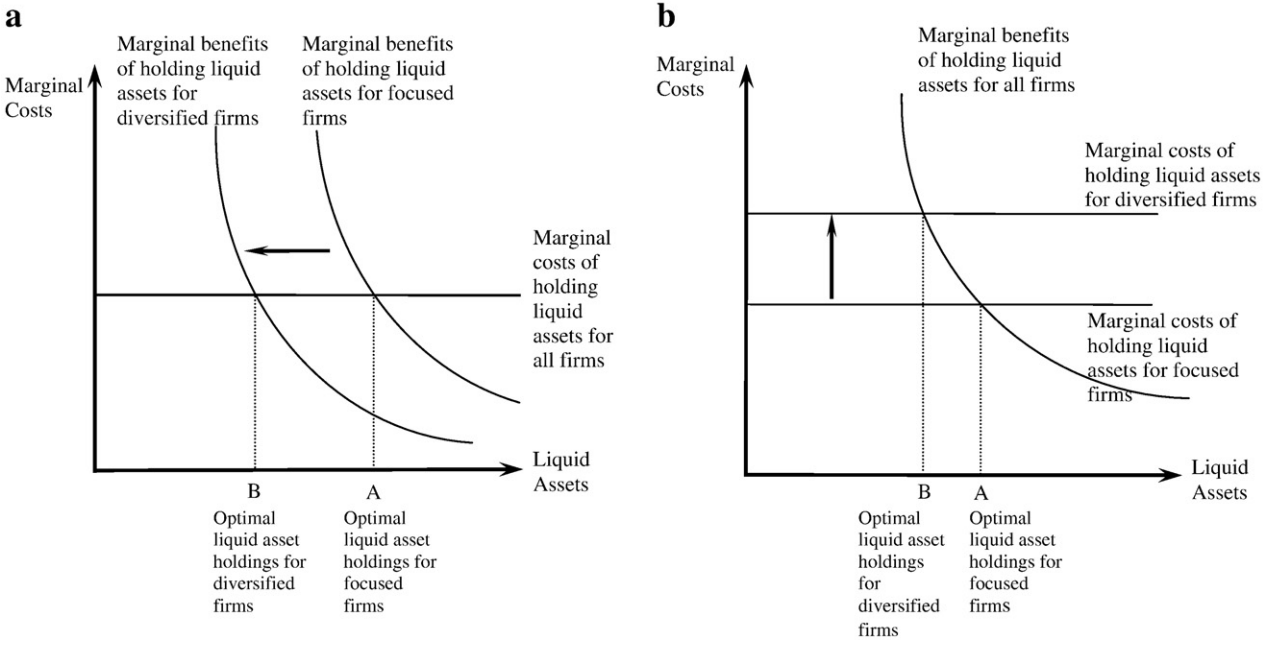

Fig. 1. Optimal holdings of liquid assets for diversified and focused firms. Fig. 1a shows that the optimal amount of liquid assets is given by the intersection of the marginal cost curve and the marginal benefit curve of holding liquid assets. The marginal cost curve of holding liquid assets is non-decreasing whereas the marginal benefit curve of holding liquid assets is decreasing (Opler et al., 1999). Due to complementary segment-level growth, availability of internal capital markets, and the ability to effectively use asset sales to finance, diversified firms have lower marginal benefits of holding cash, which implies their marginal benefit curve of holding liquid assets lies to the left of that for focused firms. Thus, A is the optimal amount of liquid asset holdings for focused firms and B is the optimal amount of liquid asset holdings for diversified firms. Fig. 1b assumes that the marginal benefit curve of holding liquid assets are the same for all firms whereas the marginal cost curve is different between diversified and focused firms. Due to a higher agency problem (Rajan et al., 2000), diversified firms are facing higher marginal costs of holding liquid assets. Again, A and B represent the optimal amount of liquid asset holdings for focused and diversified firms, respectively. One could also combine both Fig. 1a and b, which yields even lower level of optimal cash holdings for the diversified firms.

Table 1
Cash holdings by industry, 1988–2006. The table presents cash holding statistics across industries. The statistics are calculated using single-segment firms during the period of 1988 to 2006 and the industry is defined according to the 2-digit SIC code. Cash holdings are defined as Cash/Assets, which is calculated as cash and marketable securities (Compustat data item #1) divided by Assets (Compustat data item #6). Panel A shows the bottom 10 industries with the least cash holdings and Panel B shows the top 10 industries with the most cash holdings. Only industries with more than 100 observations are included.

SIC	Industry descriptions	N	Median	Mean	Std.
Panel A: Bottom 10 industries					
2200	Textile mill products	415	1.46%	5.06%	8.48%
4200	Motor freight transportation and warehouse	534	2.35%	5.92%	9.52%
3300	Primary metal industries	860	2.63%	6.18%	9.51%
5500	Food store	250	2.63%	4.99%	5.93%
5000	Wholesale trade—durable goods	1578	2.75%	8.04%	12.95%
2600	Paper and allied products	531	2.84%	6.71%	9.65%
2500	Furniture and fixtures	344	2.85%	7.41%	10.29%
5300	General merchandise stores	541	3.29%	6.45%	7.62%
3000	Rubber and miscellaneous plastics products	629	3.36%	7.55%	9.76%
2000	Food and kindred products	1419	3.49%	9.07%	12.91%
Panel B. Top 10 industries					
4700	Transportation services	140	12.22%	20.15%	21.90%
4500	Transportation by air	556	12.50%	15.71%	12.94%
9900	Nonclassifiable establishment	307	12.66%	24.04%	27.67%
3500	Industrial and commercial machinery and computer equipment	4078	15.89%	22.55%	21.39%
8700	Engineering, accounting, research and management	1047	16.75%	26.81%	26.40%
3600	Electronic (except computer equipment)	5294	18.20%	24.49%	22.50%
3800	Measuring instruments; photographic, watches and clocks	4103	20.00%	27.10%	25.07%
8200	Educational services	164	21.14%	27.83%	20.64%
7300	Business services	7587	30.74%	33.86%	25.27%
2800	Chemicals and allied products	5039	37.56%	41.70%	32.69%

3. Data and methodology

We compile our sample using Compustat Industry Segment (CIS) annual data from 1988 to 2006. Statement of Financial Accounting Standards (SFAS) No. 14 requires firms to report information for segments that represent 10% or more of consolidated sales for fiscal year ending after December 15, 1977.[4] We start the sample period in 1988 rather than 1977 because Segment Industry Classification (SIC) codes are not available before 1988 from Compustat. A firm is classified as a diversified firm if it reports more than one business segment with different SIC codes at the 2-digit level.[5] Otherwise, it is classified as a focused firm. All of the following data restrictions follow Berger and Ofek (1995). We exclude firms with any segment in a financial industry (SIC 6000–6999), a utility industry (SIC 4900–4999), and firms reporting negative segments sales or assets. The segment data are then merged with the Compustat industry annual file to obtain firm level data. Firm-years with total assets less than ten million dollars are removed. If the summation of segment sales is more than 101% (or less than 99%) of the firm's total sales, or the summation of segment assets is more than 125% (or less than 75%) of the firm's total assets, we consider it either a data error or a mismatch of the segment-level data to the firm-level information, and so we remove that data point. The final sample in our study includes 52,277 focused firm-years and 7147 diversified firm-years. Our data include survivors and non-survivors that appear on Compustat at any time in the sample period.

Different industries have different levels of cash holdings (as first illustrated in Chudson (1946)). Table 1 shows cash holdings for each 2-digit SIC code industry. To avoid any ambiguity in the industry affiliation, we only include focused firms in this computation. The top ten industries (panel B) hold as much as ten times more cash as a percentage of total assets than the bottom ten industries (panel A). For example textile mill products, the industry with the lowest cash holdings, has a median (mean) of 1.46% (5.06%), whereas chemicals and allied products, the industry with the highest cash holdings, has a median (mean) of 37.56% (41.70%). The large industry variation for cash holdings indicates that controlling for the industry effects is crucial for the purpose of our analysis.

However, simply adding industry dummies to the regression explaining cash holdings is not appropriate for our analysis. This paper examines the difference in cash holdings between diversified and focused firms and the former by definition operates in more than one industry; therefore, adding industry dummy variables could at best control for the industry specific effect of its primary industry. As a result, this paper designs a new methodology, similar in spirit to the approach used in Berger and Ofek (1995), to construct the main dependent variable—*industry-adjusted* cash holdings. We first calculate the median ratio of cash over total assets (CASH/TA) for each industry based on the single-segment firms in that industry.[6] We then define imputed cash holdings, ImputedCash for each segment of a diversified firm, as the product of that segment's industry median (CASH/TA) and its segment asset value. Lastly, adding up ImputedCash for each segment of a diversified firm gives us the firm-level ImputedCash. This variable estimates a diversified firm's cash holdings had all its segments operated as stand-alone businesses. It rests on segment accounting data and calculates the "imputed value" as a benchmark value for the conglomerate by adding up imputed

[4] SFAS14 was replaced by SFAS131 in 1997, which requires firms to disclose more segment information.
[5] If a firm reports two or more segments that are all in the same industry, we regard the firm as a focused firm.
[6] The industry median ratios are based on 2-digit SIC code that includes at least ten single-line businesses.

segment values. Our main dependent variable is the difference between the actual cash holdings of the diversified firm and the ImputedCash, scaled by total assets of the firm. We call this variable ADJCASH in all the regressions. Positive ADJCASH indicates that the diversified firms hold more cash than their stand-alone counterparts and negative ADJCASH indicates that diversified firms hold less cash compared with the stand-alone counterparts. For single-segment firms, we do the same calculation and the ADJCASH is again defined as (Cash − ImputedCash)/TA. Since we use the single-segment firms as benchmark to calculate the ADJCASH for the focused firms, the median ADJCASH for all the focused firms should be zero. The methodology of using the ADJCASH variable effectively controls for any industry effects in our analysis.

This method of computing imputed cash holdings adjusted for industry affiliation is not without its limitations though. The industry adjustment inherent in this construction assumes that focused (stand-alone) firms in the industry are comparable to segments of diversified firms that operate in the same business line. A major point of our paper is that stand-alone firms are not the same as segments of a diversified firm as far as cash needs go, at least due to the three theories we discuss. But there may be other latent and systematic differences as well (see Graham et al., 2002; Campa and Kedia, 2002; Hyland and Diltz, 2002; Villalonga, 2004) such as how a diversified firm came to be diversified (e.g., poorly performing single-segment firms were acquired to form diversified firms). In this study's context, it's possible that diversified firms were formed when financially constrained single-segment firms were bought off by larger and financially unconstrained firms. We deal with the possible endogeneity problem two different ways. First, in addition to ADJCASH we also use the unadjusted, Cash to Total Assets ratio, along with the primary industry dummy variable as a control variable in the regressions to control for the industry affiliation of the diversified firms. The empirical results indicate that the inferences are all unchanged. However, as pointed out before, since diversified firms by definition operate in more than one industry, the primary industry control can at best only be a partial control for industry affiliation. Second, we also use a comprehensive set of firm-specific control variables in all the regressions based on the prior literature on cash holdings, such as investment expenditures, R&D, bond rating, profitability, leverage, etc. to catch any other systematic differences between stand-alone firms and diversified firms that are not captured by the three theories we present in this paper.

Our hypotheses require us to measure three sets of important independent variables. The first group measures the degree to which growth opportunities among segments complement each other and the actual level of internal capital market activity in diversified firms. The second captures the frequency of using asset sales as a financing method, and the effectiveness of such asset sales. The last measures agency and influence costs in firms.

The degree of complementarity in growth opportunities among segments is measured using the mean of the time-series correlation between segments' growth opportunities. We follow the existing literature to proxy each segment's growth opportunity by using the median market-to-book ratio of focused firms in that segment's industry. For every two segments in the diversified firm, we calculate the correlation between their growth opportunities during the sample period. We then compute the mean of the correlations (MEANQCOR) for each two-segment combination. All focused firms have MEANQCOR equal to one. The higher the MEANQCOR, the higher is the correlation between segments' growth opportunities, and therefore, fewer are the complementary effects within the firm. According to the complementary growth hypothesis, as MEANQCOR increases it increases the benefits of holding cash, and thereby the optimal level of cash holdings. So, MEANQCOR is predicted to be positively related to cash holdings. This is our main variable for the complementary growth hypothesis.

We also measure the difference in growth opportunities across segments using another, possibly more direct, measure, DIVERSITY. This measure was first developed by Rajan et al. (2000), and is also subsequently used in papers such as Billett and Mauer (2003). To measure the difference in growth opportunities among segments, DIVERSITY is defined as the standard deviation of the segment asset-weighted Tobin's Q (TobinsQ) of the firm divided by the mean Tobin's Q of all segments in the firm.[7] The higher the DIVERSITY, the larger are complementarities in growth opportunities. So, the complementary growth hypothesis predicts that DIVERSITY will be negatively related to cash holdings.

The complementary growth in segments only suggests the possibility that diversified firms can have less cash holdings to meet the growth needs. But it assumes that there is free flow of funds across segments of diversified firms. So, a related condition for the complementary growth hypothesis is that the firms do actually allocate cash among different segments. Following Berger and Hann (2003), we use the variable MINTER to directly measure the flow of funds within the firm. For each year, we first calculate the excess capital expenditure over its own cash flows for each segment, i.e. Excess CAPX = Max [CAPX − (OPS + DEP), 0], where CAPX = capital expenditure, OPS = operating profits, DEP = depreciation expense. All variables are deflated by total assets. When a segment has capital expenditures larger than its own operating cash flow, then the segment may be receiving financing inflows from other segments. Since some of this excess capital expenditures may be financed with external financing sources or from past year cash flows as well (and not through internal capital market activity), we have to control for firm level financing and investment effects. So, to isolate inter-segment cash flow transfers, we adjust for the firm level excess capital expenditure, and define the variable Transfer as the Max (sum of excess CAPX − Firm level excess CAPX, 0), where the sum of excess CAPX is over all the segments of the firm. MINTER is then defined as the mean of Transfer during the sample period. It measures the average internal cash flows across divisions in diversified firms. For focused firms, MINTER is equal to 0. The complementary growth hypothesis predicts that MINTER should be negatively related to cash holdings.

We construct three variables to measure the possibility, use, and effectiveness of asset sales. MSALEPPE measures how often the firm sells property, plant and equipment. For a firm-year, if the sale of property, plant and equipment is bigger than zero (Compustat data item 107), we let Dumsaleppe = 1, else Dumsaleppe = 0. The asset sales hypothesis suggests that asset sales can be used in lieu of external financing. It however does not mean that in the year that a firm sells assets, it has less cash holdings.[8]

[7] Tobin's Q is calculated as the ratio of the market value and book value of the firm.

[8] Actually the opposite may be true. When a firm sells assets, it may receive a large amount of cash and increase the cash holdings temporarily.

Therefore, we take the average of Dumsaleppe during the sample period and name it MSALEPPE. If asset sales frequently serve as an alternate method of financing, such firms would have less need for cash holdings. The asset sales hypothesis predicts that MSALEPPE will be negatively related to cash holdings. We also use LOSSASSET to measure the effectiveness of asset sales. MSALEPPE can only indirectly measure the effectiveness of asset sales. If a firm effectively uses asset sales as an external financing method, it should earn a profit or at least sell the assets at relatively low discounts. For a firm-year, if the loss from asset sales (Compustat data item 213) is larger than zero, we let DuMLOSSA = 1, else DuMLOSSA = 0. We then take the average of DuMLOSSA during the sample period and name it MLOSSA. MLOSSA indicates how often a firm has losses when it sells its PPE and Investment.

Table 2
Variable definitions. The table describes the definition of variables used in the paper.

Variable name	Definition	Compustat data item
Cash holdings	Cash/Asset	Data1/Data6
ImputedCash	Imputed Cash $= \sum_{i=1}^{n} \left(Asset_i * \left(\frac{Cash}{Asset} \right)_{Industry_i} \right)$	Segment data item at and Compustat Data 1
ADJCASH	(Cash − ImputedCash)/Asset	(Data1 − ImputedCash)/Data6
Size	Natural log of Asset	Data6
Growth opportunity (market to book value or TobinsQ)	Market value of the firm (book value of asset less the book value of the equity, plus the market value of the equity), divided by book value of the assets	(Data6 − Data60-Data74 + Data199*Data25)/ Data6
Total leverage	Total debt over total assets	Data181/Data6
Cash flow	Earnings before extraordinary items, plus depreciation and amortization divided by assets	(Data14 + Data18)/Data 6
Net working capital	Working capital, less cash, divided by assets	(Data179 − Data1)/Data6
Invest	Capital expenditure divided by assets	Data128/Data6
R&D	Research and development spending over sales	Data46/Data12
DiversificationDummy	1 for firms operating in more than one segment and 0 otherwise	Segment data
DivDum	1 if the firms pay dividend in that year and 0 otherwise	Data21 and Data19
Bonddum	1 if firms debt has an investment grade rating (bbb or higher), 0 if otherwise	Data280 (bond rating)
FirmSigma	FirmSigma is a measure of the volatility of a firm's cash flow over the time period. It is the mean of the standard deviations of the cash flow over assets.	(Data14 + Data18)/Data 6
MEANQCOR	Mean of correlations between segments' growth opportunities. For each industry (defined as 2-digit sic), we first get the median of TobinsQ in each year during the sample period. A correlation between every two industries is then calculated. This correlation can measure how growth opportunities vary together for these two industries. MEANQCOR is defined as the mean of the correlations between every two segments. Focused firms have MEANQCOR equal to 1.	
DIVERSITY	DIVERSITY means the diversity of growth opportunities between segments. Following Rajan et al. (2000), this variable is calculated as the standard deviation of segment asset-weighted TobinsQ's for the firm divided by the equally weighted average TobinsQ of segments in the firm.	
MINTER	MINTER is a direct measurement of internal capital market. It follows Berger and Hann (2003). For every year, we calculate Transfer as Max(sum of excess CAPX-firm level excess CAPX, 0), where excess CAPX = Max(CAPX − (OPS + DEP), 0), CAPX = capital expenditure, OPS = operating profits, DEP = depreciation expense. All variables are deflated by total assets. MINTER is the mean of Transfer during the sample period.	CAPX, OPS, DEP in segment data
MSALEPPE	For a firm-year, Dumsaleppe = 1 if data107>0 and 0 otherwise. MSALEPPE is defined as the mean of Dumsaleppe during the sample period and it indicates how often the firm sells Property, Plant and Equipment.	Data107(sale of property, plant and equipment)
MLOSSA	For a firm-year, DuMLOSSA = 1 if data213>0 and 0 otherwise. MLOSSA is defined as the mean of DuMLOSSA during the sample period and it indicates how often the firm loses when sell PPE and Investment	Data213(sale of PPE and Invest − Loss(Gain))
SDP	For a diversified firm, we first calculate DP as depreciation expense divided by sales for each segment. SDP is defined as DP of the non-core segment (the one with the least sales) minus the average DP of all the segments in the firm. For focused firms, SDP is 0. For each firm, SDP indicates the level of illiquid assets in the non-core segment of the firm.	DEP, SALES in segment data
INEFFI	INEFFI is a measure of potential over-investment caused by agency problem. For every industry (defined by DNUM) and year, we calculate the mean TobinsQ. If in that year, a firm's TobinsQ is lower than the mean of the industry, DlowTobinsQ is 1 and 0 otherwise. DlowTobinsQ is a dummy variable that indicates whether a firm is operating below the industry TobinsQ. INEFFI is defined as the interaction term beween DlowTobinsQ and firm's investments, INEFFI = DlowTobinsQ*Invest.	Invest = Data128/Data6
CGINDEX	Is the corporate governance index (G-Index) computed by Gompers et al. (2003). It is based on 24 governance factors from the corporate charter provisions within the firm that are counter to shareholder interests.	G-Index originally computed based on data provided by Investor Responsibility Research center.

The higher the MLOSSA, the less effectively asset sales serve as an alternate financing channel. The asset sales hypothesis predicts that MLOSSA will be positively related to cash holdings. MSALEPPE and MLOSSA are our two main variables for the asset sales hypothesis.

As a third variable in this regard, we estimate the level of illiquid assets (assets not part of the current assets) in the non-core segments of diversified firms to examine whether that is positively related to the firm's cash holdings. Since segment data does not provide a breakup of the segment-level asset structure, such as segment-level plant property and equipment, we use segment-level depreciation expenses to estimate this variable. For each segment we compute the ratio of depreciation expenses to sales (DP). We identify the non-core segment of a diversified firm as the segment with the least sales. We then compute our main variable, standardized depreciation expense (SDP), as the DP of the non-core segment minus the average DP of all the segments in the firm. By definition, the SDP of focused firms would be zero. The asset sales hypothesis argues that higher is the SDP, the higher are the illiquid assets in the non-core segment and so higher should be the cash holdings of the firm.

To measure the severity of influence costs and agency costs within a firm, we rely on two very different metrics. Our first metric is an indirect measure that draws from the observed investment efficiencies within a firm. We use the variable INEFFI, which measures the potential over-investment by firms. For every industry and year, we calculate the median TobinsQ. In a given year, if a firm's TobinsQ is lower than the industry's median, DlowTobinsQ is set to one, and is set to zero otherwise. DlowTobinsQ is used to indicate whether the firm has fewer growth opportunities as compared to the industry median. INEFFI is defined as the interaction between DlowTobinsQ and the investment level of the firm, i.e. INEFFI = DlowTobinsQ*Invest. Firms with larger INEFFI have invested more in a low growth area, and we use this variable to measure the potential over-investment caused by agency problems. Our influence costs hypothesis predicts that INEFFI is negatively related to cash holdings. This is our main variable for the agency/influence cost hypothesis.

The second measure of agency costs is the corporate governance index developed by Gompers et al. (2003). We label the index CGINDEX for the empirical tests in our paper. For each firm, Gompers, Ishii, and Metrick use 24 different governance rules within the firm that run counter to shareholder interests to compute the index. The higher the index, the higher are the hurdles to good governance, and so weaker is the governance in the firm. We borrow this variable from their paper. Since governance provisions in any given firm are presumably not changing much from year to year, Gompers et al. (2003) recompute the index only about every other year. Within our sample period, 1988–2006, CGINDEX is computed for the years 1990, '93, '95, '98, '00, '02, '04, and '06. The agency hypothesis argues that firms with higher agency problems (poorly governed firms), i.e., firms with a higher CGINDEX would have higher costs of holding cash and so would have lower cash holdings.

Variables used to control for other determinants of cash holdings follow Opler et al. (1999). The main determinants of cash holdings that they identify are industry, market-to-book ratio, size, cash flow, net working capital imbalance, investment, leverage, R&D and dividend. Since we control for industry effect at the segment level when we construct our main dependant variable ADJCASH, we do not include industry dummies or industry cash flow volatility in our regressions. We include all the other control variables. The market-to-book ratio measures the likelihood that a firm is expected to have positive net present value projects in the future. The higher the market-to-book ratio, the higher are the growth options in the firm. Size is calculated as the natural logarithm of the book value of assets. Cash flow is defined as earnings after interest, dividend, and taxes, but before depreciation and amortization, divided by total assets. Firms may choose to insure themselves against losses by holding liquid assets besides

Table 3
Firm Characteristics by Organization Structure, 1988–2006. The table compares firm characteristics between focused and diversified firms. The sample includes 52,277 observations for focused firms and 7147 observations for diversified firms during the period of 1988 to 2006. For variable CGINDEX, there are 9099 observations for focused firms and 2517 observations for diversified firms. The focused and diversified firms are identified by their SIC code. The definitions of these variables are shown in Table II. All continuous variables are winsorized at top and bottom 1% level.

Variable names	Focused firms		Diversified firms		T-Stat for difference in means
	Mean	Median	Mean	Median	
NSEG	1.000	1.000	2.385	2.000	−510.4
CashHoldings	0.205	0.105	0.068	0.036	48.88
ADJCASH	0.048	0.000	−0.038	−0.032	35.65
Asset	797	100	2359	360	−28.93
Size	4.853	4.615	5.953	5.888	−51.86
Leverage	0.480	0.452	0.584	0.574	−30.16
TobinsQ	2.105	1.515	1.514	1.272	28.84
R&D	0.308	0.000	0.021	0.000	17.6
Invest	0.069	0.045	0.059	0.048	10.76
Wcapital	0.089	0.075	0.135	0.126	−17.94
Cashflow	0.009	0.072	0.064	0.084	−20.19
Divdum	0.323	0.000	0.607	1.000	−47.86
Bonddum	0.047	0.000	0.200	0.000	−49.9
FirmSigma	0.125	0.071	0.066	0.041	33.59
MEANQCOR	1.000	1.000	0.467	0.502	432.85
DIVERSITY	0.000	0.000	0.335	0.319	−403.2
MINTER	0.000	0.000	0.005	0.003	−154.59
MSALEPPE	0.367	0.250	0.452	0.375	−17.95
MLOSSA	0.230	0.154	0.201	0.111	8.96
SDP	0.000	0.000	0.024	0.004	−97.31
INEFFI	0.040	0.016	0.037	0.024	4.10
CGINDEX	8.562	8.000	10.068	10.000	−25.80

cash and some firms liquidate receivables as a means of raising cash, so we use working capital minus cash as a measure of liquid asset substitutes. The investment of the firm is measured by capital expenditure divided by total assets. Leverage is calculated by using the debt-to-assets ratio defined as the sum of (long-term debt + short-term debt) divided by total assets. We use the R&D expense-to-sales ratio to proxy for potential financial distress costs. A dividend dummy variable is set to one in the year where a firm pays a dividend and zero otherwise. Definitions of all the variables are summarized in Table 2.

4. Empirical results

4.1. Descriptive statistics

Table 3 reports the summary statistics for focused and diversified firms and the difference in the various characteristics between the two groups. First, diversified firms have median (mean) cash holdings of 3.6% (6.8%) of their assets, which is only about one third of the cash holdings for focused firms, whose median (mean) is 10.5% (20.5%). The median ADJCASH for focused firms is 0 as we expect because ADJCASH is measured with respect to focused firms. The median (mean) ADJCASH is −3.2% (−3.8%) for diversified firms, which implies that diversified firms hold less cash not only when cash is measured as a percentage of assets but also after we control for industry affiliation at the segment level. Diversified firms in our sample on average are operating in two industries. Diversified and focused firms differ in possible determinants of cash holdings as well. For example, diversified firms are larger than focused firms in general (median size of $100 million of assets for focused firms versus $360 million for diversified firms) and diversified firms have better bond ratings than focused firms. Given Opler et al. (1999) find that firm size and bond ratings are important determinants for cash holdings, the difference in these factors between diversified and focused firms can lead to different levels of cash holdings. So, in subsequent tests we control for these and other factors found to be relevant in Opler et al. (1999) to examine whether diversified firms hold less cash than focused firms even after these controls. Finally, we also observe that there are significant differences between diversified and focused firms in their propensity for and efficiency in generating funds through asset sales. The average MSALEPPE is 0.452 for diversified firms and 0.367 for focused firms, suggesting that diversified firms indeed use asset sales more often than focused firms. This is consistent with the notion that diversified firms are more likely to sell their non-core segment assets. MLOSSA is 0.201 for diversified firms and 0.230 for focused firms, suggesting that diversified firms sell assets in a more effective way (i.e., at smaller discounts). The preliminary evidence is consistent with the asset sales hypothesis. Also, consistent with the agency cost hypothesis, we find that diversified firms have weaker governance on average (median CGINDEX of 10 in diversified firms versus 8 for focused firms).

4.2. Regression evidence

In this section we examine whether diversified firms hold less cash once we control for the previously found determinants of cash holdings in a multiple regression setting. We also test the three proposed hypotheses on the relationship between firm structure and cash holdings.

Table 4 presents the regressions with ADJCASH as the dependent variable. Regression 1 in Table 4 quantifies the effect of firm structure on cash holdings by including all the cash determinants suggested by Opler et al. (1999) as well as a dummy variable for firm structure (divers-dummy), which is one for a diversified firm and zero for a focused firm, in a multivariate regression (with fixed year effects). It shows that the effect of firm structure is both economically and statistically significant. Diversified firms hold significantly less cash than focused firms even after controlling for all the previously established determinants of cash holdings such as size, leverage, market to book ratio, R&D expense, capital expenditure, net working capital, earnings, dividend, credit rating, and cash flow volatility. The variable is statistically significant at the 1% level of significance. The coefficients on the control variables are consistent with those found in Opler et al. (1999).

In order to further evaluate the material impact of a diversified firm structure on cash holdings we study the economic significance of the variable in addition to the statistical significance reported above. To examine economic significance we use the coefficient of the variable from Regression 1 of Table 4 and the means of this variable and the means of the dependent variable (ADJCASH) in the focused- and diversified-firms sub-samples, from Table 3. The regression coefficient indicates that as we move from the focused to the diversified firms, there is a statistically significant decrease in ADJCASH. But is the drop in ADJCASH attributable to this variable economically significant? From Regression 1 of Table 4, the coefficient of divers-dummy, −0.019, which indicates that when we move from the average value of divers-dummy of 0 among focused firms to the value of 1 among diversified firms, ADJCASH drops by $-0.019*(0-1)=0.019$. This represents a sizable (22%) part of the change in the mean of ADJCASH, which goes from 0.048 to −0.038. That is, −0.019 is 22% of the 0.086 change in the mean of ADJCASH going from the focused to diversified firms.

The complementary growth hypothesis predicts that the higher are the complementarities in growth opportunities, the lower are the cash holdings. We measure the complementary growth and the internal capital markets activity with the average of correlations between segment growths (MEANQCOR), and the differences in growth opportunities across segments in a firm (DIVERSITY), and inter-segment transfer of funds (MINTER). Regression 2 in Table 4 shows that cash holdings are significantly positively related to MEANQCOR. This is consistent with the complementary growth hypothesis as higher MEANQCOR indicates lower complementarities in growth. Also, DIVERSITY has a negative coefficient (Regression 3 of Table 4) that is significant at the 1% level, which indicates that as complementarities increase cash holdings decrease. The effect of MINTER on cash is less clear as its coefficient (Regression 4 of Table 4) fails marginally to be statistically significant.

Table 4
Effects of firm structure on cash holdings, 1988–2006. This table reports various regression results with industry-adjusted cash holdings as the dependent variable. The industry-adjusted cash holdings are calculated as cash minus imputed cash divided by total assets. Imputed cash holdings are the sum of the segment assets multiplied by the industry median of cash holdings, i.e. $\sum_{i=1}^{n}\left(Asset_i*\left(\frac{Cash}{Asset}\right)_{Industry_i}\right)$. Firm structure is represented using a dummy variable, which is 1 if the firm is diversified and 0 otherwise. Independent variables are defined in Table 2. Intercepts and year dummies are included but omitted from the table. T-statistics are reported in parenthesis. *** and ** indicate significance at 1% and 5% levels, respectively.

Independent variable	Regression (1)	Regression (2)	Regression (3)	Regression (4)	Regression (5)
Size	0.001	0.001	0.001	0.001	0.002
	(2.93)***	(3.04)***	(2.91)***	(3.02)***	(3.14)***
Leverage	−0.297	−0.297	−0.297	−0.297	−0.296
	(−109.28)***	(−109.37)***	(−109.38)***	(−109.28)***	(−108.71)***
TobinsQ	0.015	0.015	0.015	0.015	0.015
	(35.18)***	(35.23)***	(35.22)***	(35.21)***	(34.84)***
R&D	0.018	0.018	0.018	0.018	0.018
	(31.71)***	(31.68)***	(31.67)***	(31.70)***	(31.76)***
Invest	−0.293	−0.293	−0.292	−0.293	−0.290
	(−30.38)***	(−30.40)***	(−30.31)***	(−30.39)***	(−29.93)***
Wcapital	−0.288	−0.289	−0.288	−0.288	−0.288
	(−76.45)***	(−76.62)***	(−76.54)***	(−76.47)***	(−76.26)***
Cashflow	−0.027	−0.027	−0.027	−0.027	−0.027
	(−6.60)***	(−6.57)***	(−6.61)***	(−6.64)***	(−6.52)***
Divdum	−0.020	−0.020	−0.020	−0.020	−0.019
	(−13.21)***	(−13.37)***	(−13.24)***	(−13.23)***	(−12.95)***
Bonddum	−0.051	−0.051	−0.051	−0.051	−0.051
	(−16.61)***	(−16.64)***	(−16.71)***	(−16.59)***	(−16.49)***
Firmsigma	0.040	0.040	0.040	0.040	0.039
	(6.94)***	(6.94)***	(6.94)***	(6.94)***	(6.74)***
Divers-dummy	−0.019	0.000	0.001	−0.021	−0.019
	(−9.20)***	(−0.04)	(0.19)	(−8.68)***	(−9.14)***
MEANQCOR		0.036			
		(5.37)***			
DIVERSITY			−0.059		
			(−6.04)***		
MINTER				0.442	
				(1.59)	
MSALEPPE					−0.004
					(−2.11)**
MLOSSA					0.008
					(3.07)***
N	59,424	59,424	59,424	59,424	59,424
Adj. R^2	32.59%	32.62%	32.63%	32.59%	32.60%

Regression 5 of Table 4 tests the asset sales hypothesis using MSALEPPE and MLOSSA, which measure the frequency and effectiveness of selling fixed assets, respectively. The coefficient of MSALEPPE is −0.004 with a t-statistic indicating significance at the 5% level of significance and the coefficient of MLOSSA is 0.008 with a t-statistic significant at the 1% level. The regression results are consistent with the view that firms that engage in more asset sales and those that have fewer losses from asset sales have lower levels of cash holdings because these firms are able to use asset sales as an efficient form of financing. This evidence is consistent with the asset sales hypothesis. In addition, Regression 6 shows that SDP is positively and statistically significantly related to firms' cash holdings, consistent with the view that firms' whose non-core segment's assets cannot be easily converted to cash hold more cash.

To test the agency cost hypothesis, we first use INEFFI to measure the level of inefficient investment in the firm and thus indirectly infer the level of agency problems within the firm. The larger is this variable, the higher are the agency costs, and consequently, the lower should be the cash holdings. Regression 7 in Table 4 shows that the effect of this variable on cash is significantly negative. The coefficient of INEFFI is −0.075 with a t-statistic of −5.74, which is statistically significant at the 1% level of significance. The results indicate that firms with higher agency costs tend to hold less cash, which is consistent with the influence costs hypothesis. This evidence also rejects the potential alternative hypothesis where cash holdings are expected to be positively correlated with measures of influence costs (as would be the case if cash holdings are the *cause of* rather than the response to agency costs in diversified firms.)[9] Our second proxy for agency problems, CGINDEX, also yields similar results. Regression 8 in Table 4 shows that higher is the CGINDEX (i.e., weaker is the governance in the firm), lower are the cash holdings, which is consistent with the view that when agency costs go up, the cash level goes down.

[9] The key argument in the influence cost hypothesis is that diversified firms take effective actions to reduce their cash holdings in order to avoid fights over resource due to empire building. To address the question of whether lower cash holdings and agency problems can co-exist (i.e., should lower cash holdings fully solve the agency problems?), we examine time-series changes in the two variables. In results not reported in the tables, we find that changes in INEFFI are significantly negatively correlated with changes in ADJCASH. This suggests that consistent with our hypothesis, increased agency/influence costs are met with decreases in cash holdings.

Independent variable	Regression (6)	Regression (7)	Regression (8)	Regression (9)	Regression (10)
Size	0.001	0.001	−0.009	0.002	−0.008
	(2.88)***	(2.98)***	(−6.17)***	(3.31)***	(−5.59)***
Leverage	−0.297	−0.297	−0.234	−0.297	−0.234
	(−109.25)***	(−109.44)***	(−33.97)***	(−108.94)***	(−33.97)***
TobinsQ	0.015	0.014	0.005	0.014	0.005
	(35.17)***	(31.18)***	(4.79)***	(30.93)***	(4.98)***
R&D	0.018	0.018	0.014	0.018	0.014
	(31.72)***	(31.85)***	(6.99)***	(31.88)***	(7.15)***
Invest	−0.293	−0.250	−0.226	−0.248	−0.233
	(−30.39)***	(−20.57)***	(−9.27)***	(−20.3)***	(−9.48)***
Wcapital	−0.288	−0.289	−0.292	−0.289	−0.295
	(−76.36)***	(−76.62)***	(−29.93)***	(−76.59)***	(−29.99)***
Cashflow	−0.027	−0.028	−0.027	−0.027	−0.028
	(−6.59)***	(−6.78)***	(−2.01)**	(−6.66)***	(−2.09)**
Divdum	−0.020	−0.020	−0.012	−0.020	−0.013
	(−13.19)***	(−13.4)***	(−3.96)***	(−13.29)***	(−4.18)***
Bonddum	−0.051	−0.051	−0.035	−0.051	−0.034
	(−16.59)***	(−16.76)***	(−8.42)***	(−16.67)***	(−8.29)***
Firmsigma	0.040	0.040	0.039	0.039	0.038
	(6.93)***	(6.99)***	(2.13)**	(6.78)***	(2.06)**
Divers-Dummy	−0.021	−0.019	−0.013	0.001	0.003
	(−9.19)***	(−9.22)***	(−3.57)***	(0.01)	(0.41)
MEANQCOR				0.036	0.028
				(5.40)***	(2.70)***
MSALEPPE				−0.004	0.003
				(−2.23)**	(0.88)
MLOSSA				0.008	0.022
				(3.06)***	(4.04)***
SDP	0.055				
	(1.68)*				
INEFFI		−0.075		−0.074	
		(−5.74)***		(−5.71)***	
CGINDEX			−0.005		−0.005
			(−9.35)***		(−9.26)***
N	59,424	59,424	11,616	59,424	11,616
Adj. R^2	32.59%	32.63%	24.40%	32.67%	24.56%

Lastly, we include the main proxies for all three hypotheses into the same regression simultaneously (Regressions 9 and 10 of Table 4) to test whether they are three independent explanations. The results are the same as in the regressions when they are added independently: MEANQCOR, MSALEPPE, MLOSSA, INEFFI, and CGINDEX are all statistically significant as predicted and with the expected sign.[10] Both regression results also indicate an important observation: once the proxies that capture the effects predicted by our three hypotheses are included, the firm structure dummy becomes statistically insignificant. This suggests that complementary growth, asset sales, and agency costs are the main characteristics that cause diversified firms to have less cash holdings than focused firms. When these three factors are controlled for, diversified firms do not significantly differ from focused firms in their cash holdings.

In order to further evaluate the material impact of these variables on cash holdings and to understand the relative importance of the three hypotheses, we study the economic significance of these variables along the lines mentioned earlier in this section. To examine economic significance we use the coefficients of the variables in Table 4 (mainly Regression 9) and the means of the explanatory variables and the means of the dependent variable ADJCASH in the focused- and diversified-firms sub-samples, seen from Table 3. Regression 9 of Table 4 indicates that the coefficient of MEANQCOR, 0.036, which indicates that when we move from the average MEANQCOR of 1 among focused firms to a mean of 0.467 among diversified firms, ADJCASH drops by $0.036*(1-0.467)=0.019$. This

[10] We also ran an 11th regression, not reported in Table 4, that included all the independent variables simultaneously (not just the main ones for each theory), and all of the variables, except MINTER, were statistically significant and with the expected sign. MINTER had the expected sign, but continued to be marginally insignificant.

represents a very sizable 22% of the change in the mean of ADJCASH, which goes from 0.048 to −0.038. That is, 0.019 is 22% of the 0.086 change in the mean of ADJCASH going from the focused to diversified firms.

A larger level of economic significance may be seen in the DIVERSITY variable (Regression 3 of Table 4). The coefficient of DIVERSITY, −0.059, indicates that when we move from the average DIVERSITY of 0 among focused firms to 0.335 among diversified firms, ADJCASH drops by $-0.059*(0-0.335)=0.02$. This is 23% of the 0.086 change in the mean of ADJCASH going from the focused to diversified firms.

When we perform a similar analysis on the other variables, MSALEPPE, MLOSSA, INEFFI (Regression 9), SDP (Regression 6), and CGINDEX (Regression 10) which serve as tests of the asset sales and the agency/influence costs hypotheses, we find very different results. The coefficient of MSALEPPE, −0.004 indicates that when we move from the average MSALEPPE of 0.366 among focused firms to 0.443 among diversified firms, ADJCASH drops by $-0.004*(0.367-0.452)=0.00034$. This is less than 1% of the 0.086 change in the mean of ADJCASH going from the focused to diversified firms. Similarly weak economic explanatory power of well below 1% may be seen in the MLOSSA, SDP, and INEFFI variables as well. Only CGINDEX fairs a little better with an economic impact of about 8.7%. These results suggest that although all three hypotheses, complementary growth, asset sales, and agency/influence costs hypotheses are statistically significant, only the complementary growth hypothesis is economically significant in explaining the difference in cash holdings across focused and diversified firms.

Perhaps more importantly, once we include the variables measuring complementarities in growth across segments, divers-dummy is no longer economically significant. Its coefficient of 0.001 in Regression 9 of Table 4 indicates that it explains less than 1% of the change in ADJCASH. That is, $0.001*(0-1)=-0.001$, which is less than 1% of the change in ADJCASH going from focused to diversified firms. Similar results may be seen by observing the coefficient of divers-dummy in Regressions 2, 3, and 10, where the independent variables for complementarities in growth are included.

5. Robustness tests

This section performs a number of robustness tests to confirm the empirical results observed in Section 4. The first group of robustness checks is conducted using different specification and regression methods. Instead of using a dummy variable to capture diversification, we use the number of segments (NSEG) to measure the degree of diversification. To control for the potential time-series correlation of residuals, we also use Fama–Macbeth regressions instead of just fixed effects regressions. More specifically, industry-adjusted cash holdings are regressed on firm structure and other variables in each year. The average of the regression coefficients and the time-series standard deviation are then used for inference. The results are presented in Table 5. Although we include in the regressions all the control variables we previously discussed, to save space, we do not present the coefficients for these variables in the table. That is, Table 5 presents only the results for firm structure and the variables directly relevant for our three hypotheses.

Consistent with the results from previous regressions where a firm structure dummy is used, NSEG is significantly negatively related to cash holdings (as shown in Regression 1 of Table 5). Consistent with earlier results, the effect of NSEG disappears when proxies for complementary growth, asset sales, and influence costs are included in Regression 2. When Fama–Macbeth regressions

Table 5
Robustness tests with different specifications, 1988–2006. The table shows regression results from various robustness tests. The dependant variable is the industry-adjusted cash holdings, which are calculated as cash minus imputed cash, divided by total assets. Imputed cash holdings are the sum of the segment assets multiplied by the industry median of cash holdings, i.e. $\sum_{i=1}^{n}\left(Asset_i*\left(\frac{Cash}{Asset}\right)_{Industry_i}\right)$. In Regressions 1, 2, and 5, firm structure is represented using the number of segments in the firm; in Regression 3 and 4, firm structure is represented using diversified dummy. Other controlling variables such as known cash determinants that are used in Table 4 are also included each regression here but their coefficients are not reported. Regressions 1 and 2 use year fixed effect regression whereas Regressions 3, 4, and 5 use Fama–Macbeth regression by regressing adjusted cash holdings on firm structure and other variables in each year and then report the average of coefficients and t-statistics based on the time-series standard deviation. T-statistics are reported in parenthesis. *** and ** indicate significance at 1% and 5% levels, respectively.

Independent variable	Regression (1)	Regression (2)	Regression (3) Fama–MacBeth	Regression (4) Fama–MacBeth	Regression (5) Fama–MacBeth
NSEG	−0.011	0.001			0.002
	(−7.75)***	(0.69)			(1.05)
Divers-dummy			−0.019	0.000	
			(−13.37)***	(−0.10)	
MEANQCOR		0.039		0.035	0.038
		(7.4)***		(9.50)***	(11.59)***
MSALEPPE		−0.004		−0.003	−0.003
		(−2.24)**		(−1.91)*	(−1.92)*
MLOSSA		0.008		0.008	0.008
		(3.07)***		(3.25)***	(3.26)***
INEFFI		−0.074		−0.086	−0.086
		(−5.71)***		(−5.03)***	(−5.05)***
Other control variables	Included	Included	Included	Included	Included
N	59,424	59,816	19 years	19 years	19 years
Adj. R^2	32.56%	32.34%			

Table 6
Effects of firm structure on cash holdings for diversified firms, 1988–2006. The table shows impact of various organization structure characteristics on cash holdings for a sub-sample of diversified firms only during the period of 1988 to 2006. The dependant variable is the industry-adjusted cash holdings, which are calculated as cash minus imputed cash divided by total assets. Imputed cash holdings are the sum of the segment assets multiplied by the industry median of cash holdings, i.e. $\sum_{i=1}^{n}\left(Asset_i * \left(\frac{Cash}{Asset}\right)_{Industry_i}\right)$. Regressions 1 and 2 use fixed year specifications; Regressions 3 and 4 are the Fama–Macbeth regressions. T-statistics are reported in parenthesis. *** and ** indicate significance at 1% and 5% levels, respectively.

Independent variable	Regression (1)	Regression (2)	Regression (3)	Regression (4)
MEANQCOR		0.017		0.019
		(3.86)***		(4.96)***
MSALEPPE		0.000		
		(0.06)		
MLOSSA		0.014		
		(2.57)**		
SDP				0.121
				(4.60)***
INEFFI		−0.113		−0.083
		(−3.44)***		(−1.99)**
NSEG	−0.002	−0.002	−0.001	−0.003
	(−0.88)	(−0.83)	(−0.64)	(−1.40)
Other control variables	Included	Included	Included	Included
N	7,147	7,200	19 years	19 years
Adj. R^2	9.46%	9.84%		

are used in Regressions 3–5, the results are qualitatively similar: MEANQCOR, MSALEPPE, MLOSSA, and INEFFI are all statistically significant and with the predicted signs. And, both NSEG and divers-dummy are insignificant once the proxies for complementary growth, asset sales, and influence costs are included (Regressions 4 and 5 of Table 5).

The second group of robustness tests is performed on diversified firms only. For focused firms, the variable that measures internal capital market is always zero and the variable that measures complementarities in growth is always one. Focusing only on diversified firms allows us to better understand how cross-sectional variations in these variables affect cash holdings within this sub-sample. The results are presented in Table 6. Again, the previously documented control variables are included in all regressions but are not reported in the table.

The results indicate that NSEG is not statistically significant in either the fixed year effects regression or the Fama–Macbeth regression. The number of segments is irrelevant to the cash holdings for diversified firms. In addition, Table 6 finds similar effects of MEANQCOR, MLOSSA, SDP, and INEFFI as before where they are all significant and with the predicted signs. However, MSALEPPE is not statistically significant (see Regression 2 of Table 6) when we concentrate only on diversified firms. In summary, the results are largely consistent with the complementary growth and influence costs hypotheses, where MEANQCOR and INEFFI are statistically significant even in the sub-sample. In contrast, the results for the asset sales hypothesis are less straightforward as MSALEPPE becomes insignificant when the sample is restricted to only diversified firms. Also, NSEG is not significant in any of these regressions. These results are consistent with the view that diversified firms have more choices to sell assets, but their choices do not increase significantly with the number of segments. For example, firms with two segments have more opportunities to sell their non-core assets than firms with just one segment. However, the opportunities do not increase significantly when two segments increase to three or more segments. The results suggest that it is just the availability of *any* non-core assets to sell when needed, rather than the availability of increased diversity of assets that matters in this context.

Our last robustness test focuses on an apparent difference in the findings in our paper and the one in Opler et al. (1999). Using only data for the year 1994, Opler et al. (1999) test whether diversified and focused firms have different levels of optimal cash holdings. They use the number of segments in a firm as the explanatory variable but do not find any difference in the cash holdings patterns in the year 1994. The remaining part of this section tries to reconcile their results with ours. One reason for the seeming inconsistency is that Opler et al. (1999) do not fully control for the industry effects.[11] This paper illustrates that cash holdings can vary widely across industries (as shown in Table 1). Consequently, the industry adjustment for cash holdings at the segment level is a necessary requirement for reliably estimating the impact of firm structure on cash holdings. When duplicating Opler et al.'s (1999) test using unadjusted cash holdings, we obtain results similar to theirs. That is, the number of segments is not a significant cash determinant (shown in Regression 1 of Table 7). However, when we use industry-adjusted cash holdings as our dependant variable, we find a statistically significant difference in cash holdings across the firm structures (Regression 2 of Table 7) even in just 1994 data. Similar results are obtained when the firm structure dummy variable is used (due to space constraint, this regression is not reported in Table 7). These results indicate the importance of taking appropriate steps to fully control for industry effects. More importantly, consistent with our prior results, when we add the proxies for growth complementarities, asset sales, and agency cost hypotheses in the regression, although only MEANQCOR is statistically significant in this "1994 only" sub-sample, the statistical significance of NSEG, the number of segments, disappears (Regression 3).

[11] Another reason may be that they focus only on one year, 1994, for this analysis—while our tests include data over a broader period, 1988–2006.

Table 7
Effects of firm structure on cash holdings in year 1994 sample. This table replicates the test conducted in Opler et al. (1999) and shows that seeming differences in the effects of firm structure on cash is due to industry specific effects. Regression results are based on regression of cash holdings using 1994 data. Regression 1 uses the cash holdings that are not adjusted for the industry at the segment level, which follows Opler et al. (1999). Regressions 2 and 3 use cash holdings that are adjusted for industry at the segment level, which are calculated as cash minus imputed cash, divided by total assets. Independent variables are defined in Table 2. Intercepts are included but not reported. T-statistics are reported in parenthesis. *** and ** indicate significance at 1% and 5% levels, respectively.

Independent variable	Regression 1	Regression 2	Regression 3
Size	−0.009	0.003	0.003
	(−0.99)	(1.81)*	(1.82)*
Leverage	−1.158	−0.324	−0.323
	(−22.78)***	(−31.25)***	(−31.06)***
TobinsQ	0.063	0.018	0.018
	(6.79)***	(9.45)***	(8.74)***
R&D	0.239	0.022	0.022
	(22.25)***	(9.87)***	(9.85)***
Invest	−2.064	−0.367	−0.365
	(−13.94)***	(−12.14)***	(−9.81)***
Wcapital	−1.121	−0.274	−0.273
	(−17.67)***	(−21.15)***	(−21.06)***
Cashflow	−0.194	−0.055	−0.055
	(−2.47)**	(−3.41)***	(−3.41)***
Divdum	−0.059	−0.045	−0.020
	(−1.16)	(−4.26)***	(−4.00)***
Bonddum	−0.058	−0.021	−0.044
	(−2.35)**	(−4.08)***	(−4.19)***
Firmsigma	0.251	0.067	0.066
	(2.43)**	(3.17)***	(3.13)***
NSEG	−0.026	−0.011	0.001
	(−1.13)	(−2.30)**	(0.10)
MEANQCOR			0.036
			(1.98)**
MSALEPPE			0.002
			(0.25)
MLOSSA			−0.002
			(−0.33)
INEFFI			−0.001
			(−0.04)
N	3,623	3,623	3,623
Adj. R^2	41.01%	40.17%	40.17%

6. Conclusion

This paper analyzes the effect of firms' organizational structure (i.e., whether a firm is diversified or focused) on their cash holdings. Focusing on organizational structure allows us to explore non-governance related cash determinants, which complements the recent spate of research on the impact of governance mechanisms on cash holdings. There are several reasons why firm structure could affect cash holdings. We examine three hypotheses, the *complementary growth*, *asset sales*, and *influence cost* hypotheses.

First, in diversified firms, since the time-series of investment opportunities for different segments may not be perfectly correlated, the total cash need for a diversified firm may be less volatile over time. If firms hold cash for potential growth needs, diversified firms would need less to meet the investment need at any one point in time. Additionally, if there is an active internal capital market within diversified firms, the cash flow of one segment is available as capital for another segment. This reduces the need for external capital thereby reducing a benefit of holding cash. Second, diversified firms are more likely than single-segment firms to be able to raise funds by selling substantial assets, especially assets of non-core segments. This reduces the benefits of cash holdings. Hence, firms with more than one segment should have lower levels of cash holdings. Finally, agency problems, especially *influence costs* that arise from segment-managers' value-dissipating competition for firm-wide resources, are more severe among diversified firms than single-segment firms. Thus the marginal cost of holding cash and liquid assets, which exacerbate the agency costs, are higher for diversified firms than for focused firms. Hence, we would expect diversified firms to hold less cash. All three hypotheses predict that diversified firms will have less cash holdings than their stand-alone counterparts.

Using Compustat firm level and segment-level data in the 1988–2006 period, we find that diversified firms hold significantly less cash than their focused counterparts. Our results are robust to industry adjustments at the segment level and to different factors previously found to be important determinants of cash holdings. Using time-series, cross-sectional, and additional robustness tests we are able to attribute the lower cash holdings among diversified firms to complementary growth opportunities across the different segments of these firms and the availability of internal capital markets. We find that the other theories that rely on the potentially effective use of asset sales to generate cash, and the increased agency costs in diversified firms are not always

statistically significant in robustness tests, and nor are the results economically significant in explaining the lower cash holdings among diversified firms.

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