The Effects of Industry-Level Uncertainty on Cash Holdings: The Case of Germany

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Abstract

This paper investigates the link between the optimal level of non-financial firms' liquid assets and industry-level uncertainty. We develop a structural model of a firm's value maximization problem that predicts that as industry-level uncertainty increases the firm will increase its optimal level of liquidity. We test this hypothesis using a panel of German firms drawn from the Bundesbank's balance sheet database and show that greater uncertainty at the industry level causes firms to increase their cash holdings. The strength of these effects differ among subsamples of the firms with different characteristics.

Keywords: Uncertainty, cash holdings, liquidity, non-financial firms

JEL: G31, G32, L14

1 Introduction

In normal circumstances the amount of liquid assets which a non-financial firm holds is related to the general activity of the economic system and the firm's level of turnover. However, non-financial firms are observed to hold much higher levels of liquid assets then they reasonably need. For example, Google boosted its cash holdings to \$7.1 billion during 2005.[1] Why do firms hold so much cash? Why do non-financial firms invest in zero net present value investment while there are more profitable projects?[2]

Keynes (1936) suggests two main reasons that non-financial firms maintain a positive level of liquid assets. First, firms hold liquid assets to reduce transaction costs. Second, a stock of cash provides a buffer to meet unexpected contingencies.

According to the *transaction cost motive* of holding cash, firms are likely to increase their cash balances when the cost of raising funds are higher. These costs are usually associated with external financing. Dittmar and Servaes (2003) suggest that there are substantial fixed costs of acquiring outside financing as well as economies of scale in cash management. These are reasons why small firms are usually considered more likely to be financially constrained. Kim and Sherman (1998) develop a trade-off model of optimal cash holdings where a firm's cash stock depends on the expected returns on current investment opportunities.

Asymmetric information concerning the ability of raising external financing constitutes the *precautionary motive* for holding cash. Myers and Majluf (1984) define cash on hand and marketable securities as financial slack which could be used to overcome the problem of financial constraints. Furthermore, managers can increase firm value by managing their cash balances. The cash buffer allows the company to maintain the ability to invest when the company does not have sufficient current cash flows to meet capital investment demands. In their recent study Almeida, Campello and Weisbach (2004)

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[1]http://www.busrep.co.za/index.php?fArticleId=2896664

[2]In the seminal paper of Modigliani and Miller (1958) cash is considered as a zero net present value investment. There are no benefits from holding cash in a world of perfect capital markets lacking information asymmetries, transaction costs or taxes. Even in the absence of perfect capital markets firms appear to hold far more cash than any transactions-based model would imply.

investigate how macroeconomic shocks affect firms' cash flow sensitivity of cash holdings. They find that financially constrained firms' cash flow sensitivity increases during recessions, while financially unconstrained firms' cash flow sensitivity is unaffected by the business cycle. The idea of a precautionary demand for cash is further explored in recent literature. Baum, Caglayan, Ozkan and Talavera (2006) develop a static model of cash management with a signal extraction mechanism. Their model shows a positive relationship between cash holdings, the interest rate on loans and the level of uncertainty. Moreover, they find that firms behave more homogeneously in response to increases in macroeconomic uncertainty.[3]

The purpose of this paper is to provide an empirical investigation of the non-financial firm's decision to hold liquid assets. We attempt to bridge the gap in existing research by matching firm-specific data with information on their industry-level uncertainty. This matching allows us to investigate whether volatility of industry-specific input prices has significant effects on cash holding behavior.

We formulate a dynamic stochastic partial equilibrium model of a representative firm's value optimization problem. The model is based upon an empirically testable hypothesis regarding the association between the optimal level of liquid assets and industry-level uncertainty. The model predicts that an increase in volatility of input prices leads to an increase in cash holdings. To test this prediction, we utilize a panel of non-financial firms obtained from the annual Bundesbank balance sheet database over the 1987–2000 period. After screening procedures our data include more than 13,000 firm-year observations in four selected industries.

Our main findings can be summarized as follows. We find evidence of a significant positive association between the optimal level of liquidity and industry-level uncertainty as proxied by the conditional variance of industry-specific input prices. The results differ across different categories of firms.

The rest of the paper is organized as follows. Section 2 discusses non-financial firms' motives for cash holdings and reviews the related literature. Section 3 presents our

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[3]Bo and Lensink (2005) suggests that the presence of uncertainty factors changes the structural parameters of the Q-model of investment.

measure of industry-level uncertainty, while Section 4 overviews data and discusses our empirical results. Finally, Section 5 concludes.

2 The Q Model of Firm Value Optimization

The theoretical model proposed in this paper is based on the firm value optimization problem and represents a generalization of the standard Q models of investment by Whited (1992) and Hubbard and Kashyap (1992). The present value of the firm is equated to the expected discounted stream of D_t, dividends paid to shareholders, where β is the discount factor.

$$V_t(K_t) = \max_{\{I_{t+s}, B_{t+s}\}_{s=0}^{\infty}} D_t + E_t \left[\sum_{s=1}^{\infty} \beta^{t+s-1} D_{t+s} \right], \tag{1}$$

$$K_t = (1-\delta)K_{t-1} + I_t, \tag{2}$$

$$D_t = \Pi(K_{t-1}, N_t) - w_t N_t - C(I_t, K_{t-1}) - I_t + B_t - B_{t-1}R(B_{t-1}, K_{t-1}), \tag{3}$$

$$D_t \geq 0, \tag{4}$$

$$\lim_{T \to \infty} \left[\prod_{j=t}^{T-1} \beta_j \right] B_T = 0, \forall t \tag{5}$$

The firm maximizes equation (1) subject to three constraints. The first is the capital stock accounting identity $K_t = (1-\delta)K_{t-1} + I_t$, where K_{t-1} is the beginning–of–period capital stock, I_t is investment expenditures, and δ is the rate of capital depreciation. The second constraint defines firm dividends, where $\Pi(K_{t-1}, N_t)$ denotes the maximized value of current profits taking as given the beginning–of–period capital stock, K_{t-1}. The firm uses N_t units of input for production, which cost w_t per unit. The real cost of adjusting I_t units of capital is denoted as $C(I_t, K_{t-1})$.

The price of external financing is equal to the base gross interest rate, $R(B_{t-1}, K_{t-1})$ which depends on firm-specific characteristics such as debt and capital stock. Similar to Gilchrist and Himmelberg (1998), we also assume $R_{B,t} > 0$: i.e., highly indebted firms must pay an additional premium to compensate debt-holders for additional costs

because of monitoring or hazard problems. Moreover, $R_{K,t} < 0$: i.e., large firms enjoy a lower risk premium. Finally, B_{t-1} denotes financial liabilities of the firm.

At time t, all present values are known with certainty while all future variables are stochastic. In order to isolate the role of debt financing we assume that equity financing is too expensive and firms prefer debt financing only. Furthermore, managers are assumed to have rational expectations.

Financial frictions are also introduced through the non–negativity constraint for dividends, $D_t \geq 0$ and the corresponding Lagrange multiplier λ_t which can be interpreted as the shadow cost of internally generated funds. Equation (5) is the transversality condition which prevents the firm from borrowing an infinite amount and paying it out as dividends.

Solving the optimization problem we derive the following Euler equation for investment:

$$C_{I,t} + 1 = E_t \left[\beta \Theta_t \left(\Pi_{K,t+1} - C_{K,t+1} + (1 - \delta)(C_{I,t+1} + 1) - R_{K,t} B_t \right) \right] \tag{6}$$

Note that $\Theta_t = \frac{(1+\lambda_{t+1})}{(1+\lambda_t)}$. Expression $\beta \Theta_t$ may serve as a stochastic time-varying discount factor which is equal to β in the absence of financial constraints ($\lambda_{t+1} = \lambda_t$).

From the first-order conditions for debt we derive:

$$E_t \left[\beta \Theta_t \left(R_t + R_{B,t} B_t \right) \right] = 1. \tag{7}$$

In the steady state $\beta E_t\{\Theta_t\} = \beta$, which implies that $R_t + R_{B,t} B_t = 1/\beta$. If sensitivity of interest rate with respect to borrowing is equal to zero, we receive traditional steady state equality, $R_t \beta = 1$.

Combining the first order conditions we derive the measure of financial constraints:

$$E_t\{\Theta_t\} = \frac{C_{I,t} + 1 + R_{K,t}/R_{B,t} - cov(\Theta_t, \Pi_{K,t+1}) - cov(C_{I,t+1}, \Theta_t) + cov(C_{K,t+1}, \Theta_t)}{\beta(E_t\{\Pi_{K,t+1}\} + (1 - \delta)E_t\{C_{I,t+1} + 1\} - E_t\{C_{K,t+1}\} - B_t R_{K,t+1} - R_{K,t}/R_{B,t} R_t)} \tag{8}$$

From equation (8) we obtain $\partial \Theta_t / \partial \Pi_{t+1} < 0$, which means that financial constraints are likely to be relaxed when expected profitability increases.

In order to incorporate input price volatility into our theoretical framework we assume that the firm maximizes profit, defined as

$$\Pi(K_t, N_t) = P(Y_t)Y_t - w_t N_t - f_t$$

where $P(Y_t)$ is an inverse demand function and f_t represents fixed costs. The firm produces output Y given by the production function $F(K_{t-1}, N_t)$.

Expected profitability of capital, $\Pi_{K,t+1}$ is equal to the expected marginal profit of capital, which is the contribution of the marginal unit of capital to profit:

$$E_t[\Pi_{K,t+1}] = E_t\left[\frac{P_{t+1}}{\mu}\frac{\partial Y_{t+1}}{\partial K_t}\right]$$

where $\mu = 1/(1 + 1/\eta)$ and η is the price elasticity of demand, $\eta = \frac{\partial Y}{\partial P}\frac{P_{t+1}}{Y_{t+1}}$.

Assuming a Cobb–Douglas production function $Y_{t+1} = A_{t+1}K_t^{\alpha_k}N_{t+1}^{\alpha_n}$ we rewrite the marginal product of capital $\partial Y_{t+1}/\partial K_t$ as[4]

$$E_t[\Pi_{K,t+1}] = E_t\left[\frac{P_{t+1}}{\mu}\frac{\alpha_k Y_{t+1}}{K_t}\right] = E_t\left[\frac{P_{t+1}(R_t-1)}{\mu w_{t+1}}\frac{\alpha_n Y_{t+1}}{N_{+1}}\right] \tag{9}$$

If $E_t[w_{t+1}]$ is an increasing function of input price volatility, τ_{t+1}^2 (See Hartman (1976), Sandmo (1971)) then we derive our main theoretical prediction

$$\frac{\partial \Theta_t}{\partial \tau_{t+1}^2} = \frac{\partial \Theta_t}{\partial \Pi_{t+1}}\frac{\partial \Pi_{t+1}}{\partial w_{t+1}}\frac{\partial w_{t+1}}{\partial \tau_{t+1}^2} > 0 \tag{10}$$

Compared to a certainty equivalent economy, the firm facing higher costs of external financing caused by an increase in industry-level uncertainty increases its level of cash holdings.

3 Uncertainty Measures

The industry-level uncertainty identification approach resembles that of Baum et al. (2006). Firms' liquidity decisions depend on anticipation of future profits and capital investment needs. The manager's problem of determining the appropriate level of cash

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[4]We use $(\partial Y_{t+1}/\partial K_t)/(\partial Y_{t+1}/\partial N_t) = (R_t - 1)/w_{t+1}$.

holdings becomes more difficult at higher levels of uncertainty about the industry's prospects.

The literature suggests candidates for uncertainty proxies such as a moving standard deviation (see Ghosal and Loungani (2000)), the standard deviation across 12 forecast periods of output growth and the inflation rate in the next 12 months (see Driver and Moreton (1991)). However, as in Driver, Temple and Urga (2005) and Byrne and Davis (2002) we use a GARCH model for measuring industry-level uncertainty. We argue that this approach is better suited in our case for two reasons. First, industry-level forecasts are not as generally available as are macroeconomic forecasts. Second, even when they are available, disagreement among forecasters may not represent a valid uncertainty measure and is likely to contain measurement errors.

Our industry-level uncertainty proxy is calculated using a two-stage procedure. First, we estimate "pure industry input prices" as the residual from regressing monthly industry input price indices on the German overall input price index (Bundesbank data item $UUZF01$). The monthly industry price indices are taken from the Genesis database (item $61241BM013$) and cover the period from January 1976 to September 2005. Second, for each industry we estimate a generalized ARCH (GARCH) model where the mean equation is a first-order autoregression, allowing for ARMA errors. The specifics of the GARCH models are provided in Table 1. Each GARCH model's estimated conditional variance series, τ_t^2, is then employed in our econometric specification.

4 Empirical Implementation

4.1 Data

The Deutsche Bundesbank's balance sheet database of German companies is used to analyze the sensitivity of non-financial firms' cash holdings to industry-level uncertainty.[5] We consider firms within the following industries: manufacture of food products, beverages and tobacco (NACE 15); manufacture of textiles (NACE 17); manufacture of

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[5]For more detailed description of the data see von Kalckreuth (2003) and the references therein.

wearing apparel, dressing and dyeing of fur (NACE 18); and manufacture of chemicals and chemical products (NACE 24). These industries are selected because they have a longer time series of input prices, necessary for the estimation of a proxy for industry-level uncertainty.

Furthermore, we consider only firms which are corporations with Tax Balance Sheet (Steuerbilanz) or Commercial Balance Sheet (Handelsbilanz) types of accounting.[6] Given these restrictions the database covers, on average, 13,000 firms' annual characteristics from 1988 to 2000. For each firm-year we utilize the data items Cash and Equivalents (item $AP045$), Other Short Term Investment (item $AP047$), and Total Assets (item $AP088$), Additions to Tangible Assets during Accounting Period (item $AP022$) minus Disposals of Tangible Assets in Accounting Period (item $AP024$), Sales revenues (item $AP144$) minus, Short-term Debt (item $AP111$) for the liquid assets ratio ($Cash/TA$), the Investment-to-Asset ratio (I/TA), the Net Sales-to-Asset ratio (S/TA), and the Leverage ratio (B/TA) . Employee headcount, ($Labor$), is measured by the average number of employees in accounting period ($AP034$). Business group information is based on the business group ID ($AP037$).

We apply several sample selection criteria to the original sample. Observations with the following characteristics are removed from the sample: (a) negative values for investment-to-assets ratio; (b) those from firms that have fewer than ten observations over the time span; (c) those with values of ratio variables lower than the first percentile or higher than the 99th percentile. We employ the screened data to reduce the potential impact of outliers upon the parameter estimates.

Table 2 presents descriptive statistics for $(Cash/TA)_{it}$, $(S/TA)_{it}$, $(I/TA)_{it}$ and τ^2_{it} variables for the pooled time-series cross-sectional data, 1987–2000. The median for $(Cash/TA)_t$ is 2% while the mean is 6%. This ratio is considerably lower in Germany than in the USA. Based on COMPUSTAT data, Baum et al. (2006) report that US corporations hold over 10% of their total assets in cash.

The empirical literature investigating firms' capital structure behavior has identi-

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[6] We excluded firms with Opening Balance Sheet (Eröffnungsbilanz) or Carcass Balance Sheet (Rumpfbilanz). These types of balance sheet do not cover the entire year of firm's activity.

fied that firm-specific characteristics play an important role.[7] We might expect that a
group of firms with similar characteristics (e.g., those firms with high levels of leverage)
might behave similarly, and quite differently from those with differing characteristics.
Consequently, we split the sample into subsamples of firms to investigate if the model's
predictions would receive support in each subsample. We consider four different sample
splits in the interest of identifying groups of firms that may have similar characteristics
relevant to their choice of liquidity. The splits are based on firm size, total leverage, in-
vestment to total asset ratio, and whether a firm belongs to a business group (Konzern)
or not.

The sample splits are based on firms' average values of the characteristic lying above
or below the sample median. For instance, if a firm's number of employees is above the
median of the distribution, it will be classed as large. Otherwise, it will be classed as
small. As such, the classifications are mutually exhaustive. A firm is classified as part
of a business group if it reports a business group identification number.

4.2   Econometric Results

The research design to be used in the current paper is similar to recent papers in this
area (e.g., Opler, Pinkowitz, Stulz and Williamson (1999), Alfonsina, Leonida and Ozkan
(2004), Bruinshoofd and Kool (2004)).

We derive our econometric model specification for firm i at time t:

$$\frac{Cash_{it}}{TA_{it}} = \phi_0 + \phi_1 \frac{Cash_{it-1}}{TA_{it-1}} + \phi_2 \frac{I_{it}}{TA_{it}} + \phi_3 \frac{S_{it}}{TA_{it}} + \phi_4 \tau_t^2 + \kappa_t + \omega_i + \nu_{it} \quad (11)$$

The key coefficient of interest is ϕ_4. Our theoretical framework predicts a positive sign
indicating that a higher level of the liquidity ratio is associated with a higher level of
industry-specific uncertainty.

Estimates of optimal corporate behavior often suffer from endogeneity problems, and
the use of instrumental variables may be considered as a possible solution. We estimate

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[7]See Ozkan and Ozkan (2004).

our econometric models using the system dynamic panel data (DPD) estimator. DPD combines equations in differences of the variables with equations in levels of the variables. In this system GMM approach (see Blundell and Bond (1998)), lagged levels are used as instruments for differenced equations and lagged differences are used as instruments for level equations. We report two-step estimates computed with Windmeijer-corrected standard errors from Stata's `xtabond2` package.

We build a set of instruments including $(Cash/TA)_{t-3}$ to $(Cash/TA)_{t-10}$, $(I/TA)_{t-2}$ to $(I/TA)_{t-10}$, τ^2_{t-2} to τ^2_{t-7} and $(S/TA)_{t-2}$ to $(S/TA)_{t-7}$ for the difference equations and $\Delta(Cash/TA)_{t-1}$ to $\Delta(Cash/TA)_{t-9}$, $\Delta(Sales/TA)_{t-1}$ to $\Delta(Sales/TA)_{t-9}$ and $\Delta\tau^2_{t-1}$ to $\Delta\tau^2_{t-9}$ for the level equations. The models are estimated using a first difference transformation to remove the individual firm effect.

The reliability of our econometric methodology depends crucially on the validity of instruments. We check it with Sargan's test of overidentifying restrictions, which is asymptotically distributed as χ^2 in the number of restrictions. The consistency of estimates also depends on the serial correlation in the error terms. We present test statistics for first-order and second-order serial correlation in Tables 3-4, which lay out our results on the links between cash liquidity and industry level uncertainty.

Table 3 displays results of equation (11) for all firms and two subsamples. An increase in input price volatility leads to an increase in firms' liquidity, with a statistically significant effect. Hence, our findings support the hypotheses that heightened levels of industry level uncertainty affect the firm's liquidity.

Having established the positive effect of short term debt on return on assets, we next investigate if the strength of the association varies across groups of firms with differing characteristics. Columns 2 and 3 of Table 3 report results for small and large firms. Based on the point estimates, the liquidity ratio of small firms is insensitive to changes in industry-level price volatility. We find an interesting contrast in the results for low leveraged and high leverage firms, reported in the two last columns. While firms in the former group change their liquidity ratio in response to increased volatility of input prices, the liquidity of firms in the latter group is unaffected. Both types of firms display

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significant sensitivity to expected sales, with larger effects for the low leverage category.

The first two columns of Table 4 present results for low-investment firms: those in the lower half of investment-to-assets ratio distribution versus their high-investment counterparts. Uncertainty affects both groups, but the effect on the liquidity of firms in the latter group is not statistically significant. The last two columns of Table 4 present results for firms inside business groups and outside business groups, respectively. Both types of firms are affected by industry level uncertainty, but as theory predicts the effects are statistically significant for the groups outside business groups.

In summary, we may draw several conclusions from the analysis of these four subsamples. Variations in industry level uncertainty have a strong effect on the liquidity ratios of large firms, firms that are inside business groups and have high investment or low leverage. The subsample evidence buttresses our findings from the full sample and further strengthens support for the hypothesis generated by our analytical model.

5 Conclusions

In this paper, we investigate the relationship between non-financial firms' liquidity ratio and a measure of industry-specific uncertainty in four major German manufacturing industries. Based on the theoretical predictions developed using the well-established Q model of investment, we hypothesize that firms increase their cash-to-assets ratio when the volatility of industry input prices increases. We test this hypothesis by employing the Bundesbank's balance sheet dataset of German firms for the 1988–2000 period. We find support for our hypothesis in these data, and note that firms' sensitivity to industry-level uncertainty differs meaningfully across different classes of firms. Large firms, firms outside business groups, low leverage firms and high investment firms exhibit a much greater sensitivity of their liquid assets ratio to changes in industry-level uncertainty.

Our results should be considered in conjunction with those of Baum et al. (2006) who predict that during periods of higher uncertainty firms behave more similarly in terms of their cash-to-asset ratios. Taken together, these studies allow us to conjecture that as industry level uncertainty increases the total amount of cash held by non-financial firms

will increase significantly, with negative effects on the economy. The idea behind this proposition is that cash hoarded but not applied to potential investment projects can keep the economy lingering in a recessionary phase. Since during recessionary periods firms generally are more sensitive to asymmetric information problems, cash hoarding will exacerbate these problems and delay an economic recovery.

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Appendix 1: Construction of the firm-specific measures

The following variables are used in the empirical study.

From the Bundesbank database:
AP022: Additions to tangible assets during accounting period
AP024: Disposals of tangible assets in accounting period
AP034: Average number of employees in accounting period
AP045: Cash and equivalents
AP037: Code of the business group
AP047: Other Short Term Investment
AP088: Total assets
AP111: Short-term borrowed capital
AP128: Long-term borrowed capital
AP144: Sales revenues

From the GENESIS database:
61241BM013: Index of Input Prices by two-digit industry

From the Bundesbank database:
UUZF01: Input Price Index

Table 1: GARCH proxies for Industry-Level Uncertainty

	NACE 15	NACE 17	NACE 18	NACE 24
Lagged inflation	0.965***	0.963***	0.974***	0.929***
	(0.014)	(0.016)	(0.011)	(0.020)
constant	-0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
ARCH(1)	0.061	0.037	0.063*	0.036
	(0.046)	(0.026)	(0.028)	(0.032)
GARCH(1)	0.833***	0.892***	0.886***	0.879***
	(0.131)	(0.085)	(0.054)	(0.114)
constant	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
N	342	342	342	342
log-likelihood	1391.62	1493.58	1527.52	1182.92

Note: OPG standard errors in parentheses. Models are fit to Input Prices Index. ** significant at 5%; *** significant at 1%

Table 2: Descriptive Statistics, 1987–2000

	Definition	μ	σ^2	p_{25}	p_{50}	p_{75}	N
$Cash/TA_t$	Cash / Total Assets Ratio	0.06	0.01	0.00	0.02	0.07	12,499
S/TA_t	Sales / Total Assets Ratio	2.28	1.09	1.52	2.12	2.88	12,148
I/TA_t	Investment / Total Assets Ratio	0.05	0.01	0.00	0.02	0.07	10,926
τ_t^2	Industry Level Uncertainty	0.03	0.00	0.01	0.02	0.06	12,499

Note: p_{25}, p_{50} and p_{75} represent the quartiles of the distribution, N is sample size (firm-years) while μ and σ^2 and represent its sample mean and variance respectively.

Table 3: Effects of Industry-Level Uncertainty on Cash Holdings

Dependent Variable: $Cash/TA_t$

	All	Small	Large	Low Leverage	High Leverage
$(Cash/TA)_{i,t-1}$	0.450***	0.479***	0.348***	0.385***	0.510***
	(0.081)	(0.136)	(0.082)	(0.091)	(0.135)
τ_t^2	0.114**	-0.064	0.187**	0.165*	-0.028
	(0.051)	(0.072)	(0.072)	(0.100)	(0.046)
$(S/TA)_{i,t+1}$	0.022***	0.023**	0.016	0.035**	0.014*
	(0.008)	(0.009)	(0.010)	(0.018)	(0.008)
$(I/TA)_{it}$	-0.053	-0.104	-0.029	-0.054	-0.047
	(0.057)	(0.093)	(0.058)	(0.071)	(0.076)
N	8392	3982	4229	4405	3976
Sargan	0.724	0.665	0.823	0.940	0.480
AR(1)	-6.13***	-4.24***	-4.78	-5.13	-4.08
AR(2)	0.82	1.29	-1.25	-0.82	1.28

Note: Each equation includes constant and year dummy variables. Asymptotic robust standard errors are reported in the brackets. Sargan is a Sargan–Hansen test of overidentifying restrictions (p–value reported). AR(k) is the test for k-th order autocorrelation. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Effects of Industry-Level Uncertainty on Cash Holdings

Dependent Variable: $Cash/TA_t$

	High Investment	Low Investment	Business Group	Non-Business Group
$(Cash/TA)_{i,t-1}$	0.278**	0.408***	0.338**	0.439***
	(0.117)	(0.080)	(0.160)	(0.090)
τ_t^2	0.172*	0.077	0.160	0.112**
	(0.100)	(0.070)	(0.111)	(0.054)
$(S/TA)_{i,t+1}$	0.020*	0.021**	0.026**	0.020**
	(0.011)	(0.010)	(0.013)	(0.008)
$(I/TA)_t$	-0.096	-0.052	-0.022	-0.058
	(0.252)	(0.059)	(0.120)	(0.063)
N	3983	4409	1069	7323
Sargan	0.196	0.762	0.469	0.607
AR(1)	-3.92	-5.62	-2.58	-5.57
AR(2)	0.61	-0.60	-0.05	0.70

Note: Each equation includes constant and year dummy variables. Asymptotic robust standard errors are reported in the brackets. Sargan is a Sargan–Hansen test of overidentifying restrictions (p–value reported). AR(k) is the test for k-th order autocorrelation. * significant at 10%; ** significant at 5%; *** significant at 1%.