Replicating Bates, Kahle, and Stulz (2009)

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July 21, 2020

1 Introduction

In this paper, I replicate Bates, Kahle, and Stulz (2009, Journal of Finance)'s results.

2 Results

- Summary statistics and univariate analysis (Table 1 and 2) and Figures (Figure 1, 2, 3, and 4) are well replicated, suggesting that sample construction is not very far from the paper.

- Regression results (Table 3 4, 5, and 6) are hard to replicate for some specifications, even after following the same filters and winsorizations. Especially, coefficients for **Industry sigma** is very far from reported values. When LHS variable is **Log(Cash/Net Assets)**, the results are very sensitive to outliers and I suspect there would be additional filters other than reported.

Table 1: Average and Median Cash and Leverage Ratios from 1980 to 2006

| Year	N	Aggregate Cash Ratio	Average Cash Ratio	Median Cash Ratio	Average Leverage	Median Leverage	Average Net Leverage	Median Net Leverage
1980	3,458	0.062	0.105	0.055	0.265	0.243	0.160	0.178
1981	3,715	0.056	0.122	0.058	0.253	0.227	0.132	0.161
1982	3,723	0.059	0.121	0.064	0.260	0.233	0.140	0.160
1983	4,094	0.075	0.158	0.086	0.246	0.204	0.088	0.111
1984	4,168	0.068	0.139	0.068	0.255	0.218	0.116	0.142
1985	4,114	0.068	0.141	0.069	0.269	0.230	0.128	0.151
1986	4,270	0.076	0.157	0.081	0.272	0.236	0.115	0.143
1987	4,464	0.086	0.154	0.074	0.275	0.243	0.120	0.156
1988	4,278	0.072	0.139	0.066	0.282	0.245	0.143	0.166
1989	4,114	0.060	0.136	0.062	0.287	0.255	0.151	0.177
1990	4,067	0.057	0.132	0.060	0.283	0.246	0.151	0.172
1991	4,126	0.058	0.154	0.071	0.259	0.217	0.105	0.132
1992	4,275	0.055	0.159	0.078	0.239	0.194	0.080	0.114
1993	4,690	0.059	0.169	0.081	0.227	0.183	0.058	0.097
1994	4,952	0.058	0.154	0.069	0.230	0.189	0.076	0.110
1995	5,132	0.060	0.168	0.071	0.229	0.189	0.061	0.110
1996	5,562	0.065	0.191	0.086	0.219	0.170	0.028	0.079
1997	5,601	0.068	0.190	0.089	0.233	0.181	0.043	0.088
1998	5,232	0.065	0.177	0.072	0.253	0.205	0.076	0.119
1999	5,032	0.075	0.200	0.079	0.242	0.192	0.042	0.101
2000	4,859	0.073	0.210	0.090	0.231	0.166	0.020	0.067
2001	4,318	0.080	0.218	0.109	0.240	0.167	0.022	0.053
2002	3,968	0.090	0.216	0.115	0.228	0.164	0.013	0.045
2003	3,696	0.103	0.229	0.134	0.208	0.153	-0.020	0.011
2004	3,648	0.112	0.237	0.145	0.195	0.140	-0.042	-0.006
2005	3,554	0.111	0.236	0.147	0.191	0.131	-0.045	-0.008
2006	3,474	0.105	0.230	0.134	0.203	0.139	-0.027	0.007
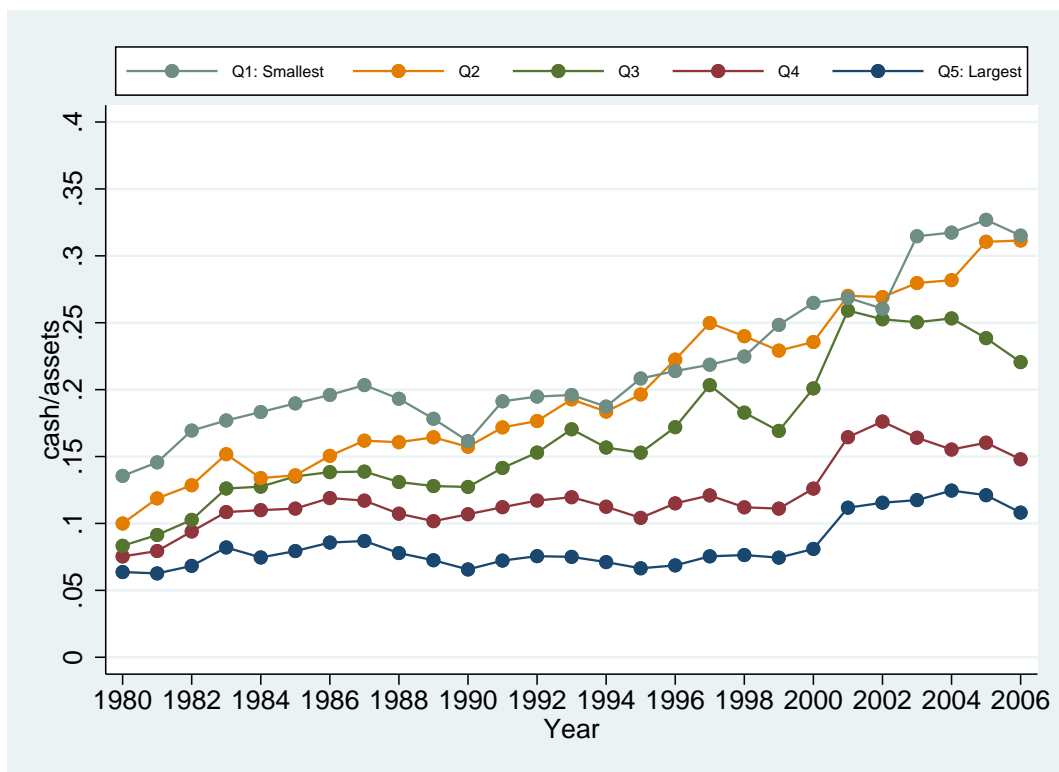
Figure 1: Average cash ratios by firm size quintile from 1980 to 2006

Table 2: Average Cash Ratios from 1980 to 2006 Delineated by New Issue Status, the Payment of Dividends, and Accounting Performance

| Year | New Issues | | Dividend Status | | Accounting Performance | |
	IPO Firms	Non-IPO Firms	Dividend Payer	Nondividend Payer	Negative Net Income	Nonnegative Net Income
1980	0.170	0.086	0.086	0.131	0.121	0.101
1981	0.195	0.090	0.092	0.153	0.143	0.116
1982	0.172	0.098	0.103	0.138	0.118	0.122
1983	0.229	0.114	0.118	0.188	0.172	0.153
1984	0.187	0.104	0.101	0.164	0.157	0.132
1985	0.187	0.106	0.106	0.163	0.148	0.137
1986	0.205	0.117	0.112	0.180	0.168	0.151
1987	0.196	0.118	0.107	0.176	0.180	0.140
1988	0.170	0.114	0.102	0.156	0.162	0.127
1989	0.164	0.117	0.099	0.154	0.143	0.132
1990	0.158	0.116	0.098	0.148	0.141	0.127
1991	0.201	0.124	0.106	0.175	0.169	0.145
1992	0.210	0.129	0.105	0.183	0.188	0.143
1993	0.227	0.129	0.105	0.194	0.209	0.147
1994	0.198	0.119	0.092	0.176	0.203	0.130
1995	0.221	0.122	0.096	0.195	0.205	0.149
1996	0.249	0.131	0.097	0.221	0.262	0.152
1997	0.241	0.137	0.105	0.216	0.253	0.153
1998	0.224	0.134	0.088	0.204	0.234	0.139
1999	0.274	0.139	0.087	0.231	0.278	0.145
2000	0.291	0.146	0.081	0.242	0.288	0.142
2001	0.306	0.165	0.091	0.250	0.284	0.147
2002	0.300	0.179	0.102	0.245	0.276	0.159
2003	0.321	0.197	0.127	0.260	0.302	0.180
2004	0.339	0.203	0.132	0.275	0.341	0.186
2005	0.313	0.213	0.133	0.277	0.331	0.189
2006	0.281	0.216	0.125	0.274	0.340	0.178
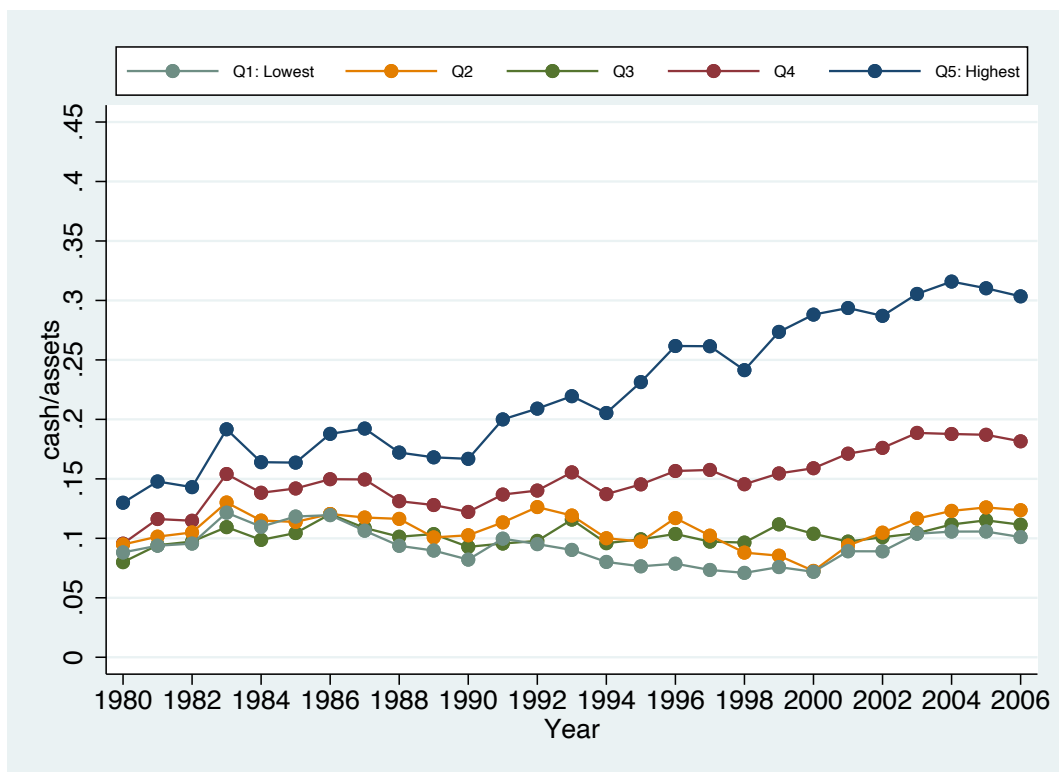
Figure 2: Average cash ratios by idiosyncratic risk
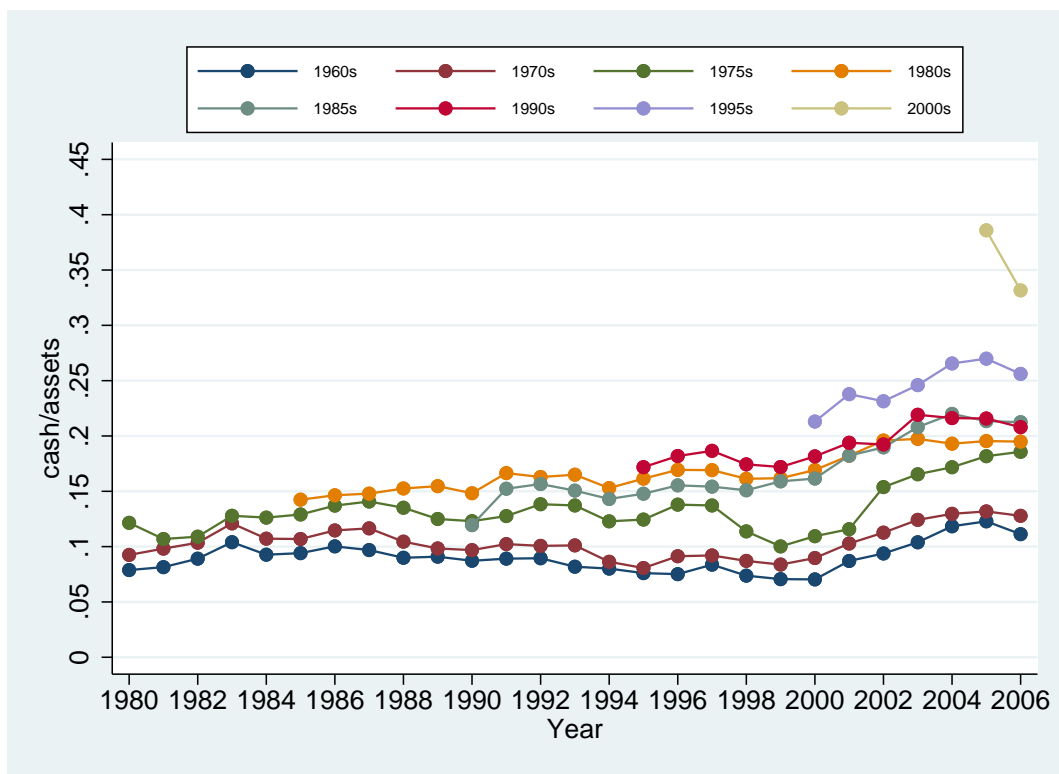
Figure 3: Average cash ratios by idiosyncratic risk

Table 3: Regressions Estimating the Determinants of Cash Holdings

Panel A

Model	OLS	OLS	Changes	OLS	OLS	Changes	F-M (1980s)	F-M (1990s)	FE
Dependent Variables	Cash/Assets	Log(Cash/ Net Assets)	Cash/Assets	Cash/Assets	Log(Cash/ Net Assets)	Cash/Assets	Cash/Assets	Cash/Assets	Cash/Assets
Constant	0.250 (0.000)	−1.602 (0.000)	0.072 (0.000)	0.254 (0.000)	−1.544 (0.000)	0.075 (0.000)	0.311 (0.000)	0.216 (0.000)	
Lag dcash			−0.092 (0.000)			−0.092 (0.000)			
Lag cash			−0.246 (0.000)			−0.248 (0.000)			
Industry sigma	0.728 (0.000)	5.736 (0.000)	0.146 (0.000)	0.833 (0.000)	7.371 (0.000)	0.167 (0.000)	0.177 (0.077)	0.981 (0.000)	0.748 (0.000)
Market to book	0.017 (0.000)	0.144 (0.000)	0.005 (0.000)	0.017 (0.000)	0.148 (0.000)	0.005 (0.000)	0.011 (0.000)	0.019 (0.000)	0.019 (0.000)
Real size	−0.006 (0.000)	−0.053 (0.000)	−0.000 (0.567)	−0.004 (0.000)	−0.035 (0.001)	−0.000 (0.746)	−0.010 (0.000)	−0.004 (0.011)	−0.006 (0.000)
Cash flow/ assets	−0.003 (0.765)	0.072 (0.350)	0.060 (0.000)	−0.001 (0.896)	0.093 (0.278)	0.061 (0.000)	0.024 (0.045)	−0.004 (0.731)	0.014 (0.134)
NWC/ assets	−0.229 (0.000)	−2.008 (0.000)	−0.094 (0.000)	−0.232 (0.000)	−2.055 (0.000)	−0.094 (0.000)	−0.219 (0.000)	−0.249 (0.000)	−0.209 (0.000)
Capex	−0.360 (0.000)	−2.446 (0.000)	−0.309 (0.000)	−0.373 (0.000)	−2.643 (0.000)	−0.310 (0.000)	−0.302 (0.000)	−0.459 (0.000)	−0.410 (0.000)
Leverage	−0.360 (0.000)	−3.596 (0.000)	−0.085 (0.000)	−0.362 (0.000)	−3.629 (0.000)	−0.086 (0.000)	−0.356 (0.000)	−0.352 (0.000)	−0.288 (0.000)
R&D/ sales	0.060 (0.000)	0.346 (0.000)	0.017 (0.000)	0.060 (0.000)	0.342 (0.000)	0.017 (0.000)	0.057 (0.000)	0.057 (0.000)	0.062 (0.000)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dividend dummy	−0.039 (0.000)	−0.276 (0.000)	−0.006 (0.001)	−0.043 (0.000)	−0.335 (0.000)	−0.007 (0.000)	−0.029 (0.000)	−0.051 (0.000)	−0.020 (0.000)
Acquisition activity	−0.231 (0.000)	−1.781 (0.000)	−0.350 (0.000)	−0.226 (0.000)	−1.700 (0.000)	−0.349 (0.000)	−0.116 (0.000)	−0.282 (0.000)	−0.206 (0.000)
1990s dummy				−0.026 (0.000)	−0.401 (0.000)	−0.009 (0.020)			
2000s dummy				−0.018 (0.024)	−0.279 (0.002)	−0.003 (0.363)			
Year dummies									Yes
Adjusted R^2	0.454	0.369	0.235	0.457	0.377	0.236	0.353	0.489	0.417
Obs.	100,357	99,533	77,178	100,357	99,533	77,178	35,452	64,905	60,703

Panel B

Dependent Variables	Cash/Assets			Cash/Assets			Log (Cash/Net Assets)		
	Estimate	Interaction 1990s	Interaction 2000s	Estimate	Interaction 1990s	Interaction 2000s	Estimate	Interaction 1990s	Interaction 2000s
Intercept	0.314 (0.000)	−0.104 (0.000)	−0.005 (0.735)	0.319 (0.000)	−0.101 (0.000)	0.013 (0.343)	−1.103 (0.000)	−0.734 (0.000)	−0.251 (0.040)
Industry sigma	0.134 (0.141)	0.823 (0.000)	0.121 (0.234)	0.189 (0.011)	0.707 (0.000)	0.053 (0.576)	1.747 (0.011)	6.696 (0.000)	0.285 (0.735)
Market to book	0.011 (0.000)	0.008 (0.000)	0.002 (0.427)	0.005 (0.000)	0.009 (0.000)	0.001 (0.687)	0.065 (0.000)	0.055 (0.000)	0.031 (0.186)
Real size	−0.010 (0.000)	0.007 (0.000)	0.001 (0.628)	−0.009 (0.000)	0.006 (0.000)	0.001 (0.491)	−0.063 (0.000)	0.011 (0.411)	0.051 (0.001)
Cash flow/ assets	0.027 (0.029)	−0.029 (0.058)	−0.029 (0.102)	0.082 (0.000)	−0.009 (0.609)	−0.038 (0.058)	0.622 (0.000)	−0.085 (0.575)	−0.355 (0.034)
NWC/ assets	−0.219 (0.000)	−0.009 (0.530)	−0.038 (0.044)	−0.248 (0.000)	0.014 (0.323)	−0.038 (0.048)	−2.153 (0.000)	−0.078 (0.587)	−0.021 (0.909)
Capex	−0.296 (0.000)	−0.086 (0.001)	−0.137 (0.023)	−0.421 (0.000)	−0.065 (0.022)	−0.140 (0.013)	−2.967 (0.000)	−0.418 (0.046)	−1.241 (0.062)
Leverage	−0.360 (0.000)	−0.006 (0.722)	0.022 (0.255)	−0.360 (0.000)	−0.003 (0.813)	−0.004 (0.807)	−3.621 (0.000)	−0.210 (0.052)	0.389 (0.038)
R&D/ sales	0.059 (0.000)	−0.001 (0.827)	−0.002 (0.481)	0.050 (0.000)	0.003 (0.561)	0.000 (0.981)	0.290 (0.000)	−0.008 (0.777)	0.004 (0.870)
Dividend dummy	−0.031 (0.000)	−0.018 (0.001)	−0.008 (0.158)	−0.020 (0.000)	−0.017 (0.001)	−0.014 (0.019)	−0.188 (0.001)	−0.168 (0.005)	−0.064 (0.262)
Acquisition activity	−0.102 (0.000)	−0.122 (0.000)	−0.129 (0.000)	−0.266 (0.000)	−0.102 (0.000)	−0.102 (0.001)	−1.633 (0.000)	−1.208 (0.000)	−0.813 (0.013)
Net equity issuance	0.145			0.145			0.909		

	(1)	(2)	(3)
	(0.000)		(0.000)
Net debt issuance		0.165	1.269
		(0.000)	(0.000)
Loss dummy		−0.001	−0.079
		(0.713)	(0.050)
T-bill		−0.001	−0.013
		(0.238)	(0.099)
Credit spread		0.003	0.135
		(0.544)	(0.045)
IPO1		0.032	0.156
		(0.000)	(0.000)
IPO2		0.013	0.009
		(0.006)	(0.832)
IPO3		0.001	−0.063
		(0.856)	(0.119)
IPO4		−0.002	−0.068
		(0.605)	(0.052)
IPO5		−0.004	−0.085
		(0.163)	(0.006)
Adjusted R^2	0.464	0.479	0.390

Table 4: Predicted Cash Ratios and Their Deviations from Actual Cash Holdings over Time

	Whole Sample			S&P 500 Firms			Firms Paying a Dividend			Firms Not Paying a Dividend		
	Predicted	Actual − Predicted	t-statistic	Predicted	Actual − Predicted	t-statistic	Predicted	Actual − Predicted	t-statistic	Predicted	Actual − Predicted	t-statistic
1990	0.146	−0.013	−5.38	0.092	−0.022	−4.53	0.105	−0.007	−2.21	0.164	−0.016	−4.90
1991	0.164	−0.011	−4.48	0.103	−0.035	−8.74	0.116	−0.011	−3.32	0.185	−0.011	−3.44
1992	0.169	−0.011	−4.69	0.112	−0.039	−8.89	0.123	−0.017	−5.20	0.188	−0.009	−2.87
1993	0.177	−0.010	−4.28	0.114	−0.041	−8.81	0.129	−0.018	−5.45	0.196	−0.007	−2.37
1994	0.170	−0.019	−8.34	0.113	−0.044	−8.53	0.121	−0.028	−9.09	0.187	−0.016	−5.56
1995	0.173	−0.014	−5.80	0.111	−0.042	−8.03	0.118	−0.025	−7.95	0.192	−0.010	−3.22
1996	0.179	−0.003	−1.26	0.112	−0.042	−8.25	0.119	−0.023	−7.17	0.200	0.004	1.29
1997	0.170	0.001	0.53	0.111	−0.037	−6.61	0.119	−0.016	−4.49	0.187	0.007	2.28
1998	0.154	0.003	1.26	0.108	−0.035	−6.45	0.106	−0.020	−5.52	0.170	0.011	3.37
1999	0.171	0.002	0.57	0.112	−0.034	−5.71	0.103	−0.019	−5.13	0.191	0.008	2.32
2000	0.177	0.004	1.43	0.122	−0.023	−3.29	0.106	−0.024	−6.24	0.197	0.012	3.34
2001	0.176	0.018	5.47	0.126	−0.005	−0.63	0.111	−0.021	−5.37	0.194	0.029	7.10
2002	0.178	0.018	5.23	0.128	0.004	0.45	0.120	−0.021	−4.81	0.194	0.028	6.86
2003	0.187	0.018	5.53	0.136	0.012	1.47	0.130	−0.009	−2.02	0.205	0.027	6.66
2004	0.192	0.021	6.26	0.140	0.006	0.73	0.134	−0.005	−1.12	0.215	0.031	7.25
2005	0.190	0.023	6.99	0.140	0.007	0.81	0.134	−0.005	−1.13	0.214	0.035	8.13
2006	0.183	0.023	6.91	0.132	−0.006	−0.92	0.126	−0.007	−1.81	0.207	0.035	8.21

Table 5: Determinants of Changes in Predicted Cash between 2000 and 2006

|	Whole Sample	Nondividend Paying Firms	Dividend Paying Firms	Difference	Non-S&P 500 Firms	S&P 500 Firms	Difference
Industry sigma	0.007 (0.0001)	0.007 (0.0001)	0.006 (0.0001)	0.002	0.007 (0.0001)	0.007 (0.0002)	0.000
Market to book	0.002 (0.0001)	0.001 (0.0001)	0.003 (0.0001)	−0.002	0.001 (0.0001)	0.006 (0.0002)	−0.004
Real size	−0.010 (0.0001)	−0.014 (0.0001)	−0.010 (0.0002)	−0.004	−0.010 (0.0001)	−0.008 (0.0003)	−0.002
Cash flow/ assets	−0.001 (0.0001)	−0.000 (0.0002)	0.001 (0.0001)	−0.001	−0.002 (0.0002)	0.002 (0.0001)	−0.004
NWC/ assets	0.022 (0.0004)	0.018 (0.0005)	0.021 (0.0006)	−0.004	0.021 (0.0004)	0.024 (0.0009)	−0.003
Capex	0.013 (0.0002)	0.014 (0.0003)	0.011 (0.0003)	0.003	0.013 (0.0002)	0.013 (0.0005)	−0.000
Leverage	0.020 (0.0006)	0.030 (0.0008)	0.002 (0.0010)	0.027	0.022 (0.0007)	0.002 (0.0015)	0.020
R&D/ sales	0.011 (0.0003)	0.013 (0.0005)	0.000 (0.0000)	0.013	0.012 (0.0004)	0.002 (0.0001)	0.010
Dividend dummy	0.004 (0.0001)	0.000 (.)	0.000 (.)	0.000	0.004 (0.0001)	0.005 (0.0002)	−0.001
Acquisition activity	−0.002 (0.0001)	−0.002 (0.0001)	−0.003 (0.0002)	0.001	−0.002 (0.0001)	−0.002 (0.0003)	−0.000
Net equity issuance	−0.002 (0.0005)	−0.005 (0.0007)	−0.002 (0.0002)	−0.003	−0.002 (0.0005)	−0.004 (0.0003)	0.002
Net debt issuance	−0.001 (0.0002)	−0.001 (0.0003)	−0.002 (0.0003)	0.001	−0.001 (0.0002)	−0.001 (0.0004)	−0.000
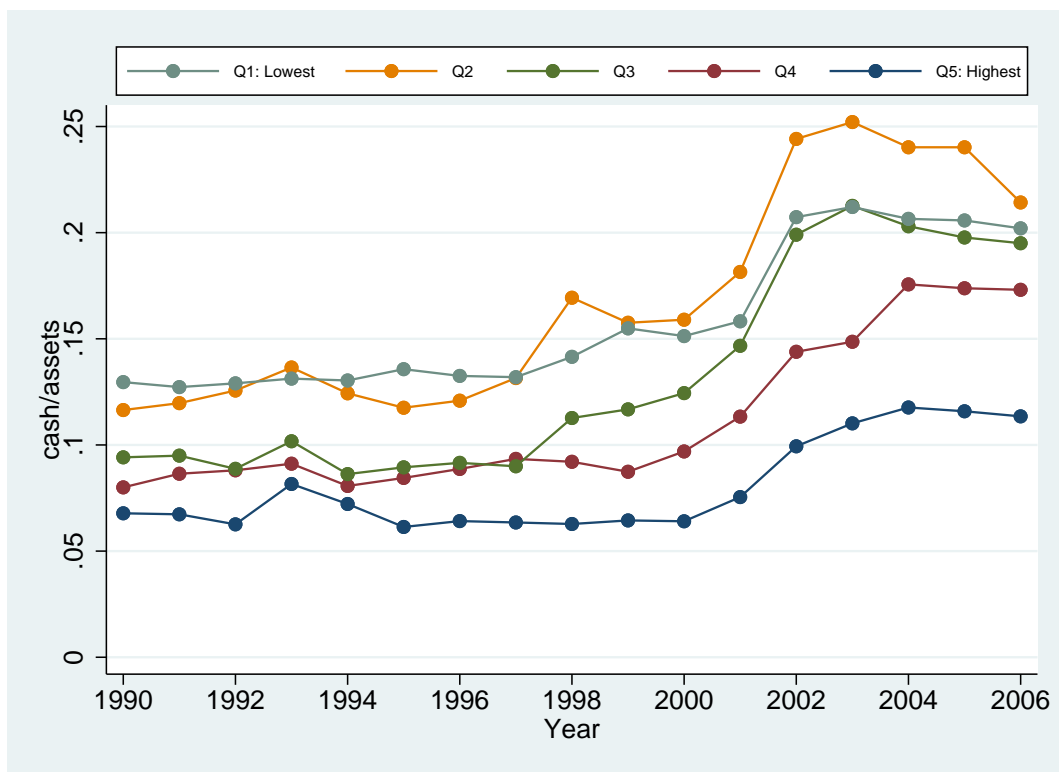
Figure 4: Average cash ratios sorted by quintiles of the GIM index from 1990 to 2006

Table 6: OLS Regression Results for the Market Value of the Firm

	(1)	(2)
Intercept	0.760	0.580
	(0.000)	(0.000)
E_t	-0.822	1.054
	(0.002)	(0.054)
dE_t	0.205	-0.086
	(0.158)	(0.365)
dE_{t+2}	-0.237	0.291
	(0.113)	(0.160)
dNA_t	0.263	0.632
	(0.005)	(0.000)
dNA_{t+2}	0.287	0.311
	(0.000)	(0.106)
RD_t	5.159	4.661
	(0.000)	(0.000)
dRD_t	0.685	1.570
	(0.006)	(0.089)
dRD_{t+2}	2.833	6.326
	(0.000)	(0.000)
I_t	3.590	-1.654
	(0.000)	(0.206)
dI_t	-5.032	-4.074
	(0.000)	(0.008)
dI_{t+2}	0.007	-3.050
	(0.993)	(0.105)
D_t	6.772	9.014
	(0.000)	(0.000)
dD_t	-1.079	-1.333
	(0.000)	(0.000)
dD_{t+2}	3.539	4.594
	(0.000)	(0.000)
dV_{t+2}	-0.088	-0.096
	(0.066)	(0.169)
L_t	1.823	1.058
	(0.000)	(0.000)
$L_t * D90s$	0.420	1.642
	(0.355)	(0.012)
$L_t * D00s$	-0.841	-0.695

	(0.209)	(0.380)
$D90s$	0.178	0.288
	(0.000)	(0.000)
$D00s$	0.071	0.033
	(0.242)	(0.579)
Adjusted R^2	0.278	0.301
Obs.	57,968	19,604