Replicating Bates, Kahle, and Stulz (2009)

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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	4,165	0.068	0.139	0.068	0.255	0.218	0.116	0.142
1985	4,112	0.068	0.141	0.069	0.269	0.230	0.128	0.151
1986	4,269	0.075	0.157	0.080	0.272	0.236	0.115	0.143
1987	4,434	0.078	0.155	0.076	0.273	0.242	0.118	0.155
1988	4,251	0.062	0.141	0.067	0.281	0.244	0.141	0.164
1989	4,094	0.056	0.137	0.062	0.285	0.252	0.148	0.174
1990	4,044	0.053	0.133	0.060	0.281	0.244	0.148	0.169
1991	4,113	0.057	0.155	0.071	0.257	0.214	0.102	0.129
1992	4,262	0.060	0.162	0.078	0.237	0.193	0.076	0.111
1993	4,672	0.059	0.171	0.081	0.225	0.181	0.054	0.095
1994	4,936	0.058	0.154	0.069	0.229	0.188	0.075	0.108
1995	5,134	0.060	0.169	0.071	0.228	0.187	0.059	0.108
1996	5,552	0.065	0.191	0.085	0.219	0.171	0.028	0.080
1997	5,594	0.068	0.190	0.089	0.233	0.180	0.043	0.088
1998	5,234	0.066	0.177	0.072	0.254	0.205	0.077	0.120
1999	5,017	0.075	0.199	0.079	0.243	0.194	0.044	0.102
2000	4,844	0.073	0.209	0.089	0.231	0.168	0.022	0.068
2001	4,300	0.079	0.217	0.108	0.241	0.167	0.024	0.054
2002	3,941	0.090	0.215	0.115	0.228	0.163	0.013	0.046
2003	3,678	0.103	0.229	0.135	0.208	0.153	-0.021	0.010
2004	3,633	0.112	0.238	0.145	0.195	0.139	-0.042	-0.005
2005	3,544	0.111	0.236	0.147	0.191	0.131	-0.045	-0.007
2006	3,464	0.105	0.231	0.134	0.203	0.139	-0.027	0.007
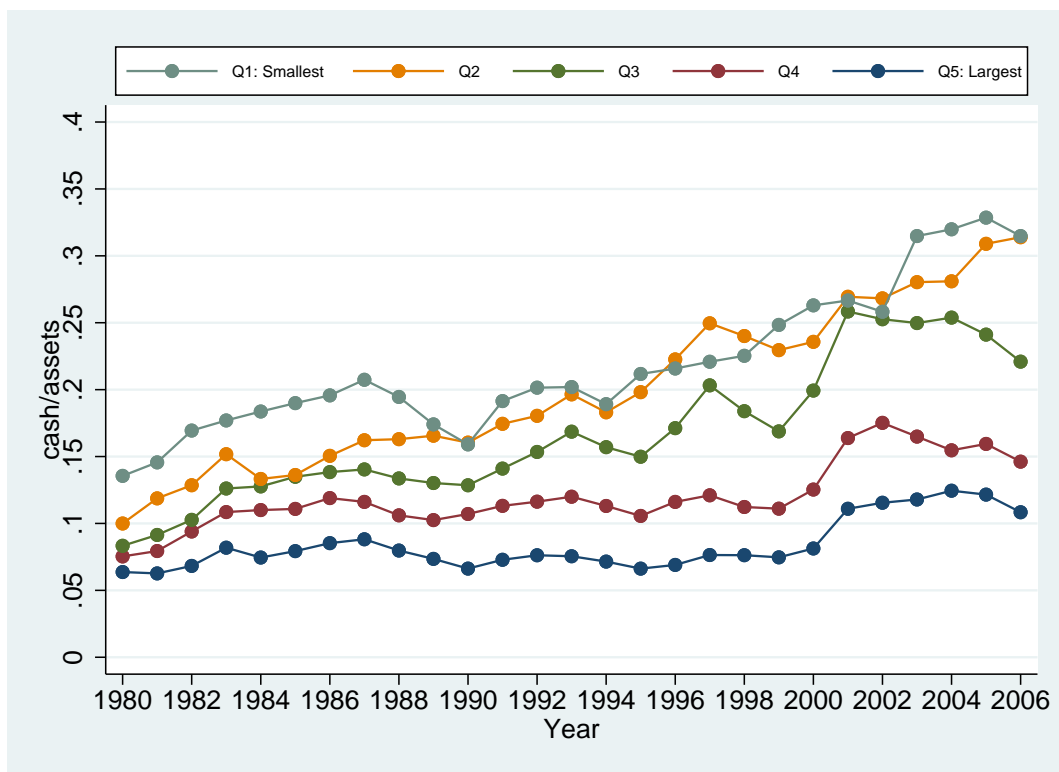
Figure 1: Average cash ratios by firm size quintile from 1980 to 2006

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

|	New Issues		Dividend Status		Accounting Performance	
Year	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	0.119	0.122
1983	0.229	0.114	0.118	0.188	0.172	0.153
1984	0.187	0.104	0.101	0.164	0.156	0.132
1985	0.187	0.106	0.106	0.163	0.148	0.137
1986	0.205	0.116	0.112	0.180	0.168	0.150
1987	0.197	0.119	0.109	0.177	0.181	0.141
1988	0.172	0.116	0.103	0.158	0.164	0.128
1989	0.163	0.119	0.099	0.155	0.143	0.133
1990	0.160	0.116	0.098	0.150	0.142	0.129
1991	0.203	0.125	0.106	0.177	0.171	0.145
1992	0.214	0.130	0.104	0.187	0.191	0.145
1993	0.228	0.131	0.105	0.197	0.213	0.148
1994	0.197	0.121	0.093	0.177	0.202	0.132
1995	0.221	0.124	0.096	0.196	0.206	0.150
1996	0.249	0.132	0.098	0.221	0.262	0.152
1997	0.240	0.139	0.104	0.217	0.253	0.154
1998	0.222	0.135	0.088	0.204	0.234	0.139
1999	0.273	0.139	0.087	0.231	0.278	0.144
2000	0.290	0.146	0.079	0.242	0.287	0.142
2001	0.305	0.164	0.090	0.249	0.283	0.147
2002	0.298	0.179	0.101	0.245	0.276	0.158
2003	0.323	0.197	0.127	0.261	0.304	0.181
2004	0.339	0.204	0.133	0.276	0.342	0.186
2005	0.313	0.214	0.134	0.277	0.331	0.190
2006	0.281	0.217	0.124	0.275	0.339	0.179
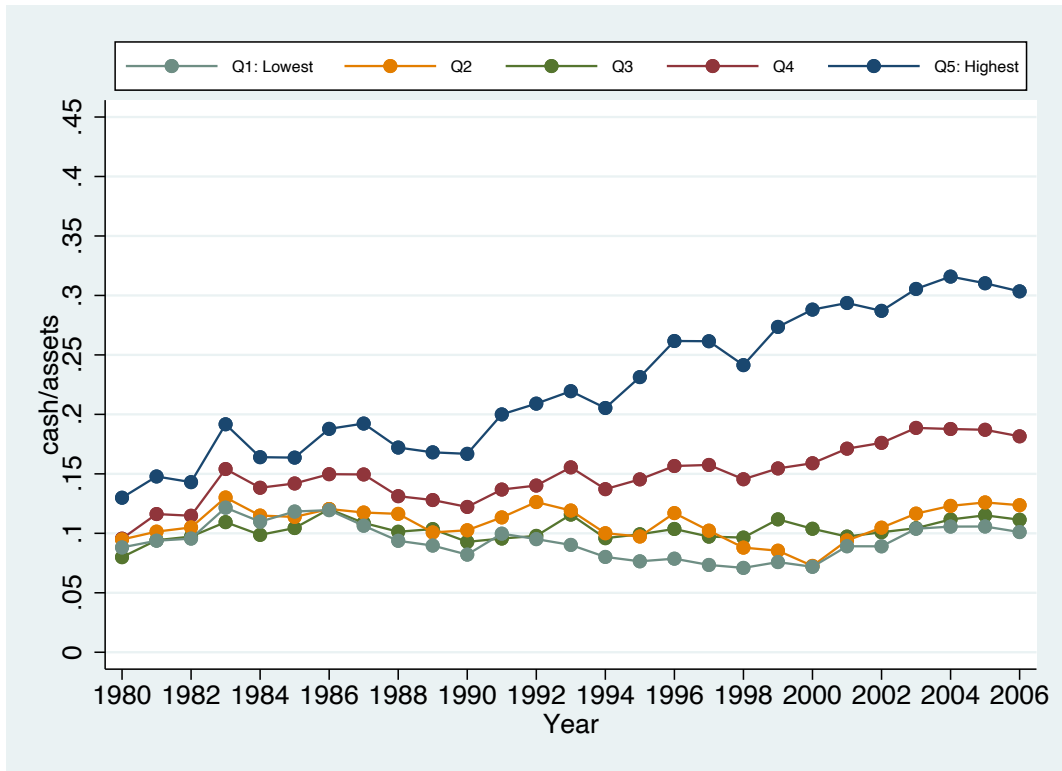
Figure 2: Average cash ratios by idiosyncratic risk
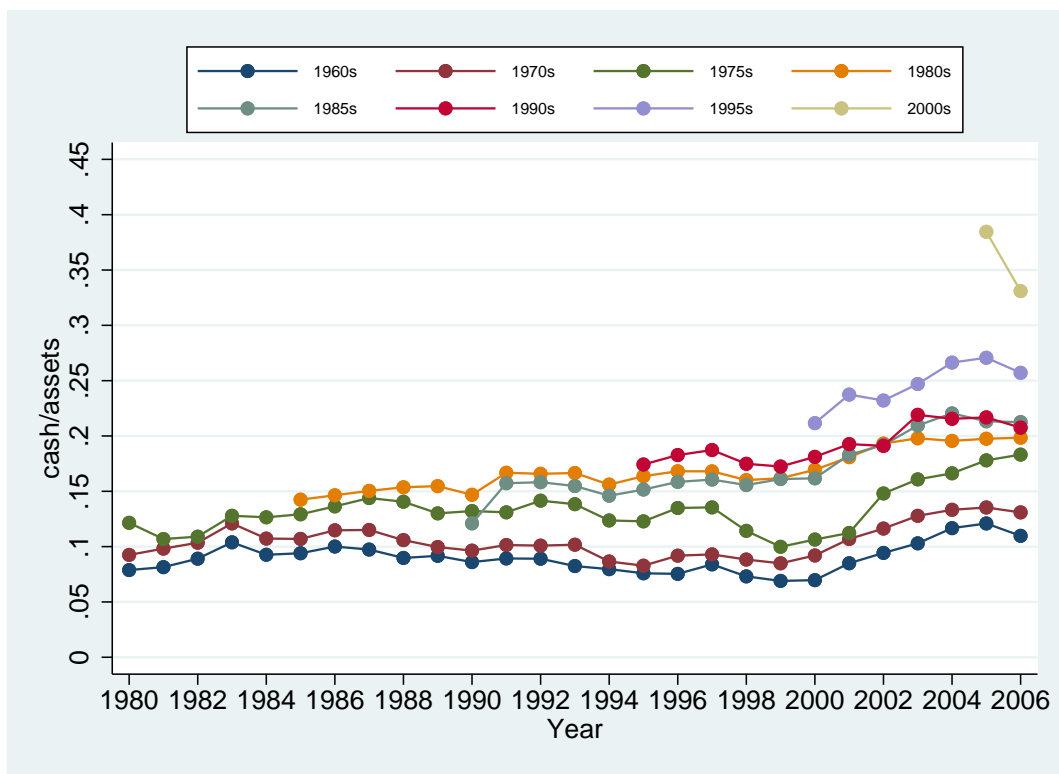
Figure 3: Average cash ratios by idiosyncratic risk

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	0.254 (0.000)	−1.564 (0.000)	0.074 (0.000)	0.257 (0.000)	−1.512 (0.000)	0.076 (0.000)	0.315 (0.000)	0.223 (0.000)	
Lag dcash			−0.092 (0.000)			−0.092 (0.000)			
Lag cash			−0.247 (0.000)			−0.249 (0.000)			
Industry sigma	0.700 (0.000)	5.461 (0.000)	0.131 (0.000)	0.806 (0.000)	7.124 (0.000)	0.151 (0.000)	0.132 (0.116)	0.929 (0.000)	0.706 (0.000)
Market to book	0.017 (0.000)	0.146 (0.000)	0.005 (0.000)	0.017 (0.000)	0.151 (0.000)	0.005 (0.000)	0.011 (0.000)	0.019 (0.000)	0.019 (0.000)
Real size	−0.006 (0.000)	−0.054 (0.000)	−0.000 (0.609)	−0.005 (0.000)	−0.036 (0.000)	−0.000 (0.772)	−0.010 (0.000)	−0.004 (0.012)	−0.006 (0.000)
Cash flow/ assets	−0.002 (0.815)	0.069 (0.392)	0.060 (0.000)	−0.001 (0.939)	0.090 (0.311)	0.061 (0.000)	0.026 (0.025)	−0.004 (0.755)	0.015 (0.119)
NWC/ assets	−0.232 (0.000)	−2.024 (0.000)	−0.094 (0.000)	−0.235 (0.000)	−2.069 (0.000)	−0.095 (0.000)	−0.220 (0.000)	−0.252 (0.000)	−0.209 (0.000)
Capex	−0.363 (0.000)	−2.459 (0.000)	−0.312 (0.000)	−0.375 (0.000)	−2.645 (0.000)	−0.312 (0.000)	−0.301 (0.000)	−0.466 (0.000)	−0.412 (0.000)
Leverage	−0.363 (0.000)	−3.631 (0.000)	−0.087 (0.000)	−0.366 (0.000)	−3.668 (0.000)	−0.087 (0.000)	−0.359 (0.000)	−0.357 (0.000)	−0.291 (0.000)
R&D/ sales	0.060 (0.000)	0.344 (0.000)	0.017 (0.000)	0.060 (0.000)	0.341 (0.000)	0.017 (0.000)	0.056 (0.000)	0.057 (0.000)	0.063 (0.000)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dividend dummy	−0.040	−0.287	−0.007	−0.044	−0.346	−0.007	−0.030	−0.053	−0.022
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Acquisition activity	−0.232	−1.782	−0.352	−0.226	−1.699	−0.351	−0.114	−0.283	−0.205
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
1990s dummy				−0.025	−0.392	−0.009			
				(0.000)	(0.000)	(0.024)			
2000s dummy				−0.017	−0.276	−0.003			
				(0.025)	(0.002)	(0.415)			
Year dummies									Yes
Adjusted R^2	0.454	0.370	0.237	0.457	0.377	0.238	0.354	0.488	0.418
Obs.	99,706	98,893	77,029	99,706	98,893	77,029	35,312	64,394	60,278

Panel B

Dependent Variables	Cash/Assets			Cash/Assets			Log (Cash/Net Assets)		
Model	Estimate	Interaction 1990s	Interaction 2000s	Estimate	Interaction 1990s	Interaction 2000s	Estimate	Interaction 1990s	Interaction 2000s
Intercept	0.319 (0.000)	−0.102 (0.000)	−0.007 (0.672)	0.326 (0.000)	−0.101 (0.000)	0.013 (0.360)	−1.072 (0.000)	−0.727 (0.000)	−0.224 (0.059)
Industry sigma	0.075 (0.414)	0.857 (0.000)	0.099 (0.338)	0.118 (0.104)	0.763 (0.000)	0.010 (0.918)	1.335 (0.061)	7.089 (0.000)	−0.345 (0.678)
Market to book	0.011 (0.000)	0.008 (0.000)	0.003 (0.343)	0.005 (0.000)	0.009 (0.000)	0.002 (0.549)	0.067 (0.000)	0.056 (0.000)	0.037 (0.110)
Real size	−0.010 (0.000)	0.007 (0.000)	0.001 (0.552)	−0.009 (0.000)	0.006 (0.000)	0.002 (0.436)	−0.062 (0.000)	0.008 (0.553)	0.052 (0.001)
Cash flow/ assets	0.029 (0.013)	−0.031 (0.047)	−0.033 (0.092)	0.083 (0.000)	−0.009 (0.595)	−0.041 (0.054)	0.626 (0.000)	−0.101 (0.505)	−0.362 (0.042)
NWC/ assets	−0.219 (0.000)	−0.013 (0.375)	−0.034 (0.079)	−0.248 (0.000)	0.010 (0.504)	−0.035 (0.081)	−2.149 (0.000)	−0.113 (0.431)	0.015 (0.933)
Capex	−0.296 (0.000)	−0.091 (0.001)	−0.134 (0.029)	−0.419 (0.000)	−0.073 (0.014)	−0.137 (0.018)	−2.942 (0.000)	−0.458 (0.030)	−1.221 (0.068)
Leverage	−0.363 (0.000)	−0.008 (0.652)	0.023 (0.268)	−0.363 (0.000)	−0.005 (0.716)	−0.005 (0.802)	−3.653 (0.000)	−0.227 (0.045)	0.381 (0.053)
R&D/ sales	0.058 (0.000)	−0.000 (0.919)	−0.002 (0.485)	0.049 (0.000)	0.003 (0.560)	0.001 (0.874)	0.286 (0.000)	−0.008 (0.789)	0.011 (0.637)
Dividend dummy	−0.032 (0.000)	−0.018 (0.001)	−0.009 (0.141)	−0.021 (0.000)	−0.017 (0.001)	−0.015 (0.019)	−0.197 (0.000)	−0.169 (0.006)	−0.074 (0.215)
Acquisition activity	−0.099 (0.000)	−0.127 (0.000)	−0.125 (0.000)	−0.265 (0.000)	−0.106 (0.000)	−0.095 (0.001)	−1.614 (0.000)	−1.252 (0.000)	−0.754 (0.023)
Net equity issuance				0.144			0.902		

		(0.000)	(0.000)
Net debt issuance		0.166 (0.000)	1.282 (0.000)
Loss dummy		−0.001 (0.702)	−0.080 (0.045)
T-bill		−0.001 (0.161)	−0.013 (0.089)
Credit spread		0.002 (0.684)	0.132 (0.049)
IPO1		0.031 (0.000)	0.152 (0.000)
IPO2		0.013 (0.007)	0.008 (0.844)
IPO3		0.001 (0.760)	−0.058 (0.147)
IPO4		−0.002 (0.654)	−0.061 (0.082)
IPO5		−0.004 (0.176)	−0.084 (0.009)
Adjusted R^2	0.464	0.479	0.391

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	−5.39	0.093	−0.023	−4.60	0.106	−0.009	−2.58	0.165	−0.016	−4.74
1991	0.165	−0.011	−4.37	0.103	−0.035	−8.63	0.117	−0.012	−3.44	0.186	−0.011	−3.28
1992	0.170	−0.010	−4.20	0.112	−0.039	−8.85	0.123	−0.017	−5.26	0.189	−0.008	−2.34
1993	0.178	−0.009	−3.80	0.114	−0.041	−8.72	0.129	−0.018	−5.58	0.197	−0.006	−1.80
1994	0.170	−0.019	−8.12	0.113	−0.044	−8.58	0.121	−0.028	−9.17	0.187	−0.016	−5.32
1995	0.173	−0.012	−5.24	0.111	−0.043	−8.07	0.118	−0.025	−7.77	0.193	−0.008	−2.71
1996	0.179	−0.003	−1.25	0.112	−0.042	−8.27	0.118	−0.023	−7.07	0.200	0.004	1.27
1997	0.169	0.002	0.73	0.111	−0.037	−6.61	0.118	−0.016	−4.51	0.187	0.008	2.50
1998	0.154	0.004	1.46	0.108	−0.035	−6.41	0.106	−0.020	−5.47	0.170	0.011	3.55
1999	0.170	0.003	0.93	0.112	−0.034	−5.72	0.103	−0.019	−5.25	0.190	0.009	2.73
2000	0.177	0.004	1.47	0.123	−0.023	−3.33	0.106	−0.025	−6.87	0.196	0.012	3.49
2001	0.176	0.018	5.45	0.126	−0.005	−0.66	0.112	−0.022	−5.74	0.194	0.029	7.15
2002	0.178	0.017	4.98	0.128	0.003	0.42	0.120	−0.023	−5.23	0.194	0.028	6.71
2003	0.187	0.018	5.61	0.136	0.012	1.44	0.131	−0.009	−1.94	0.206	0.027	6.73
2004	0.193	0.021	6.28	0.140	0.005	0.63	0.135	−0.004	−0.79	0.216	0.030	7.16
2005	0.190	0.023	7.10	0.140	0.007	0.80	0.134	−0.004	−0.99	0.215	0.035	8.19
2006	0.184	0.023	7.04	0.132	−0.006	−0.97	0.126	−0.007	−1.70	0.208	0.036	8.33

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	0.021 (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)	0.029 (0.0008)	0.002 (0.0010)	0.028	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
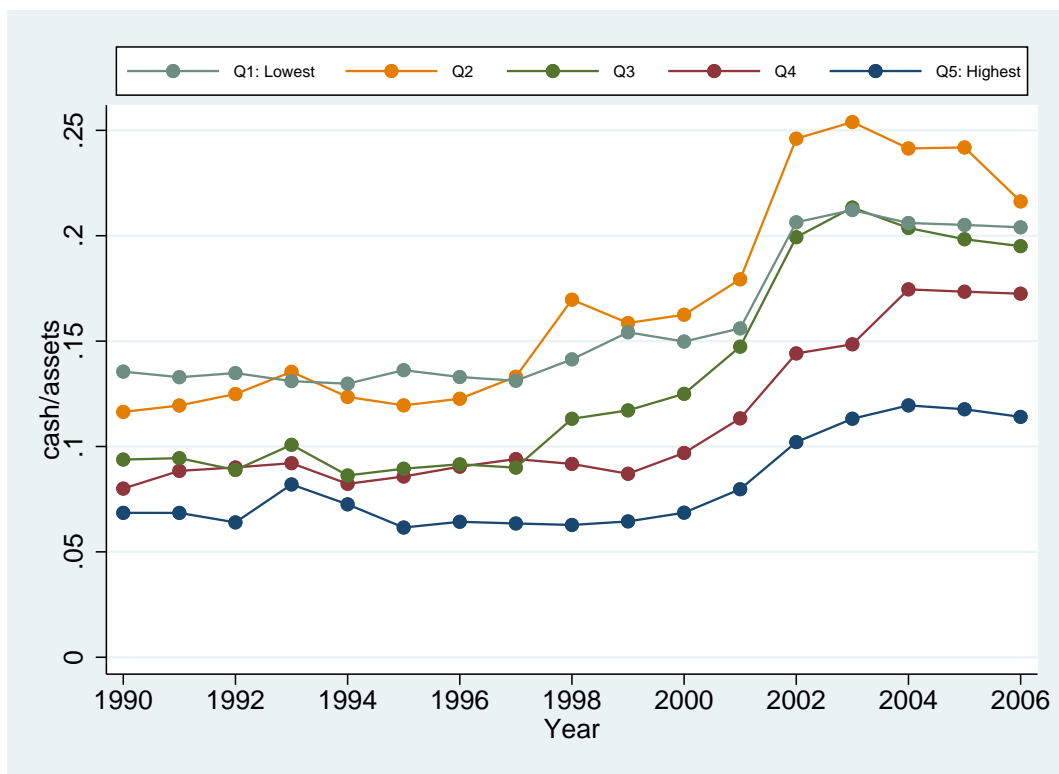
Figure 4: Average cash ratios sorted by quintiles of the GIM index from 1990 to 2006

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

	(1)	(2)
Intercept	0.736	0.657
	(0.000)	(0.000)
E_t	-0.796	1.103
	(0.001)	(0.053)
dE_t	0.155	-0.096
	(0.168)	(0.332)
dE_{t+2}	-0.213	0.303
	(0.155)	(0.132)
dNA_t	0.380	0.608
	(0.000)	(0.000)
dNA_{t+2}	0.312	0.353
	(0.000)	(0.073)
RD_t	5.337	4.705
	(0.000)	(0.000)
dRD_t	0.484	1.555
	(0.029)	(0.094)
dRD_{t+2}	2.847	6.181
	(0.000)	(0.000)
I_t	4.253	-3.195
	(0.000)	(0.011)
dI_t	-5.962	-3.431
	(0.000)	(0.019)
dI_{t+2}	-0.096	-4.491
	(0.901)	(0.029)
D_t	5.477	7.896
	(0.000)	(0.000)
dD_t	-1.260	-1.511
	(0.000)	(0.000)
dD_{t+2}	1.314	2.652
	(0.288)	(0.010)
dV_{t+2}	-0.092	-0.101
	(0.049)	(0.159)
L_t	1.866	0.915
	(0.000)	(0.000)
$L_t * D90s$	0.417	1.803
	(0.364)	(0.011)
$L_t * D00s$	-0.857	-0.771

	(0.196)	(0.374)
$D90s$	0.170	0.248
	(0.000)	(0.000)
$D00s$	0.086	0.038
	(0.162)	(0.521)
Adjusted R^2	0.276	0.301
Obs.	58,478	19,819