Why do U.S. firms hold so much more cash than they used to?

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ABSTRACT

The increase in cash holdings by U.S. firms has been a significant trend over the past few decades, prompting interest among researchers and policymakers. This study aims to replicate and extend the work of Bates, Kahle, and Stulz (2009) by utilizing updated data beyond their cutoff date and incorporating additional analyses. The research explores the factors influencing cash holdings, including recent macroeconomic events such as the global financial crisis, geopolitical tensions, the COVID-19 pandemic, rising inflation, and regulatory changes. Using a meticulous sample selection process and innovative data collection techniques, the study examines average and median cash and leverage ratios from 1980 to 2022. The findings reveal a continuous increase in cash reserves among U.S. firms and a decreasing trend in net leverage ratio. The analysis also delves into the relationship between cash holdings and various firm characteristics, such as new issue status, dividend payment, and accounting performance. Results show that newly issued firms, dividend-paying firms, and those with negative net income tend to hold more cash. Moreover, regression analysis uncovers the determinants of cash holdings, considering factors like market value, cash flow, firm size, leverage, R&D expenses, acquisitions, and interest expense. Additionally, the study introduces a Long-short portfolio strategy based on firms' average cash ratios. The analysis demonstrates that the portfolio outperforms the market and conventional Fama-French factors, suggesting that companies with higher cash ratios have a performance advantage. In conclusion, this research offers a comprehensive view of the factors driving the surge in cash holdings by U.S. firms. It provides valuable insights into the implications for corporate decision-making, investment behavior, and overall economic performance, making it a vital contribution to financial research and decision-making.

Introduction

The increase in cash holdings by U.S. firms has become a significant trend over the past few decades, raising concerns and sparking interest among researchers and policymakers alike. Understanding the reasons behind this surge in cash reserves is essential for assessing its potential impact on corporate decision-making, investment, and overall economic performance. This paper aims to replicate and extend the work of Bates, Kahle, and Stulz (2009) by using updated data beyond their cutoff date and performing additional analyses to provide a comprehensive view of the factors influencing cash holdings.

In their original study, Bates, Kahle, and Stulz (2009) analyzed data from 1980 to 2006, highlighting various factors contributing to the increase in cash-to-assets ratios. Factors such as falling inventories, increased cash flow risk, precautionary motives, reduced capital expenditures, and higher R&D expenses were identified as key drivers of this trend. Building on their findings, we seek to explore the impact of recent macroeconomic events, such as the global financial crisis, geopolitical tensions, the COVID-19 pandemic, rising inflation, and regulatory changes, on cash holdings by U.S. firms.

With this study, we set out to replicate and extend the original research by incorporating more recent data and investigating how changing business environments have influenced cash ratios. We also aim to explore the motives for holding cash, including transaction costs, precautionary measures, and investment opportunities, as well as assess the impact of firm characteristics on cash holdings. To achieve this, we utilize empirical evidence and regression models to analyze the determinants of cash holdings and draw meaningful conclusions that can provide valuable insights for researchers and policymakers. By understanding the factors behind the surge in cash reserves, we can gain a deeper understanding of its implications for corporate behavior, investment decisions, and the overall economy.

The Data

In the realm of financial research, the importance of robust data collection and analysis cannot be overstated. In this study, we set out to investigate the relationship between cash holdings and firm performance, seeking to expand on existing literature that had a cutoff date in 2006. Recognizing the significance of updated data and its potential impact on our findings, we ventured beyond the limitations of prior research.

To ensure the reliability and relevance of our conclusions, we adopted a meticulous sample selection process. Certain industries, namely financial firms (SIC code 6000-6999) and utilities (SIC codes 4900-4999), were excluded due to their distinct financial characteristics. Our sample period spanned a considerable duration from 1980 to 2022, encompassing more recent data beyond the cutoff date of related literature.

Overcoming challenges posed by unavailable and inaccurate data from certain sources, we employed an innovative approach to collect comprehensive and reliable firm data. Leveraging a Python program, we compiled information from the CRSP Database, WRDS, and other reputable sources, resulting in a dataset that includes a diverse selection of firms.

Our dataset adheres to specific criteria, ensuring the validity of our research. For the period of 1980 to 2006, we analyzed average and median cash and leverage ratios. Furthermore, we meticulously examined average cash ratios during this timeframe, distinguishing them based on new issue status, dividend payment, and accounting performance.

In addition to delving into historical data, we performed a meaningful extension by segregating firms from 1980 to 2022 into decile buckets based on their average cash ratio. Utilizing this information, we

constructed a Long-short portfolio, affording us valuable insights into cash holding practices across different financial data.

To explore the determinants of cash holdings, we harnessed a rich set of variables, including market value, cash flow, firm size, dividend dummy, net working capital, leverage, R&D expenses, acquisitions, interest expense, common dividends, cash and marketable securities, earnings, and net assets. These robustness checks allowed us to analyze the factors that significantly influence the level of cash holdings in firms.

The amalgamation of updated data, rigorous sample selection, and extension procedures positions our research as a vital contribution to the understanding of cash holdings' impact on firm performance. As we progress, we hope to shed light on new insights that will aid stakeholders in making informed financial decisions.

Under and which adhere to the following criterion:

- Average and Median Cash and Leverage Ratios from 1980 to 2006
- Average Cash Ratios from 1980 to 2006 Delineated by New Issue Status, the Payment of Dividends, and Accounting Performance
- The important data used in the regressions estimating the determinants of cash holdings include variables.
- As part of our research endeavor, we undertook a further extension involving the categorization of firms spanning the years 1980 to 2022 into decile buckets according to their average cash ratio. This strategic partitioning led us to construct a Long-short portfolio strategy, entailing the acquisition of firms positioned within the uppermost cash ratio decile while divesting from those within the lowest cash ratio decile. The ensuing step involved the computation of annual returns for this portfolio, which were subsequently subjected to regression analysis against the Fama-French factors Mkt-RF, HML, and SMB. This analytical process yielded an Alpha value, affording us a valuable measure for contextual interpretation.

Methodologies

In conducting our research, we endeavored to adhere to methodologies used by the reference paper. However, where applicable, we made certain adaptations and extensions to capture more recent data and explore evolving patterns. The following sections outline our approach in detail:

1.Cash and Leverage Ratios:

Following the reference paper's methodology, we calculated the cash ratio as the ratio of cash and marketable securities to the book value of total assets. Leverage was defined as the ratio of total debt (long-term debt plus debt in current liabilities) to the book value of total assets. Additionally, we computed the net leverage ratio by subtracting cash from total debt and dividing the result by the book value of total assets.

- Replication

We successfully replicated Tables 1, 2 and 3 of the reference paper by extracting relevant observations from the WRDS merged CRSP/Compustat files. Our results for average and median cash and leverage ratios from 1980 to 2006 aligned closely with the findings of the reference paper. The trends depicted an increasing average cash ratio from 10.5% in 1980 to 23.2% in 2006. The median and aggregate cash ratios also exhibited similar patterns.

- Extension Analysis

To capture shifts or changes in cash holding patterns and determinants beyond 2006, we extended our data analysis to cover the period from 2007 to 2022. The results obtained in this extension corroborated the reference paper's findings, indicating a continual increase in cash holdings of US firms and a decreasing trend in net leverage ratio.

We closely followed the methodologies of the reference paper, but our extension and inclusion of more recent data allowed us to delve deeper into the evolving relationship between cash holdings and firm performance, providing valuable insights for stakeholders in financial decision-making.

2. Analysis of IPO & Non-IPO Firms, Dividend & Non dividend paying firms:

We classified firms as IPO subsample if they had gone public within the prior 5 calendar years and non-IPO subsample otherwise. Our results for the average cash ratio showed a significant increase over time for both IPO and non-IPO firms. This evidence indicated that the surge in cash holdings was not solely due to IPO-related capital raising activities.

- Role of Dividends:

We analyzed the impact of dividend payment on cash holdings. The average cash ratio of dividend-paying firms remained relatively stable over the years. In contrast, non-dividend-paying firms exhibited a substantial increase in cash holdings, supporting the notion that non-dividend-paying firms, likely financially constrained, tend to accumulate more cash due to limited growth opportunities.

- Firms with Negative Net Income:

We investigated the relationship between cash holdings and accounting performance, specifically for firms with negative net income. Our findings revealed a remarkable increase in cash holdings for such firms, with the average cash ratio almost tripling over the sample period. This evidence supported the precautionary motive behind increased cash holdings in financially constrained firms.

- Incorporation of More Recent Data:

To capture shifts or changes in cash holdings patterns and determinants, we extended our analysis to encompass data from 2007 to 2022. During this extension, we obtained results consistent with the reference paper for IPO & Non-IPO firms, non-dividend-paying firms, and firms with negative net income.

In summary, while adopting methodologies used in the reference paper, we expanded the analysis by incorporating more recent data, potentially shedding light on evolving trends in cash holding patterns and determinants. Our findings strengthened the understanding of the relationship between cash holdings and firm characteristics, contributing valuable insights to the existing body of research.

3.Regression analysis

The explanatory variables in the regression models include industry sigma, market to book ratio, real size, cash flow, net working capital, capital expenditures, leverage, dividend dummy, acquisition activity, net debt issuance, net equity issuance, loss dummy, and IPO dummy variables indicating the

years since the firm went public. P-values based on robust standard errors clustered by firm and year are reported for OLS regressions.

In conclusion, the study uses a comprehensive set of explanatory variables and robust statistical techniques to analyze the determinants of cash holdings in firms. By applying various regression analyses and controlling for different factors, the researchers aim to provide reliable and valid insights into the factors influencing cash holdings in firms over the specified period.

4. Long-short portfolio strategy

The study extended the investigation of the relationship between cash holdings and firm performance by creating a Long-short portfolio strategy. Firms from 1980 to 2022 were divided into decile buckets based on their average cash ratios, with Bucket 9 representing firms with the highest average cash ratio and Bucket 0 representing firms with the lowest average cash ratio.

The Long-short portfolio strategy involved buying firms in Bucket 9 (high cash ratio) and selling firms in Bucket 0 (low cash ratio) to capture the performance difference between companies with high and low cash ratios.

To measure the performance of the Long-short portfolio, annual returns data were used. The researchers calculated the differential returns of the portfolio by subtracting the returns of the sell bucket from the returns of the buy bucket. This approach allowed them to assess the excess returns generated by the Long-short portfolio strategy.

Furthermore, a regression analysis was conducted to examine the impact of the Fama-French three factors (Mkt-RF, SMB, and HML) on the Long-short portfolio returns. These factors represent market risk, size effect, and value effect, respectively. The return series data of the Long-short portfolio were regressed on these three factors.

In conclusion, the study's extension demonstrated the potential benefits of incorporating cash holdings as a factor in investment strategies. The Long-short portfolio approach, based on decile buckets of firms' average cash ratios, exhibited significant excess returns beyond conventional market and Fama-French factors, providing valuable insights into the role of cash in firm performance and investment decision-making.

Findings

1. Average and Median Cash and Leverage Ratios from 1980 to 2022:

Year	N	Aggregate Cash Ratio	Average Cash Ratio	Median Cash Ratio	Average Leverage	Median Leverage	Average Net Leverage	Median Net Leverage
1980	3,519	0.063	0.105	0.055	0.269	0.243	0.164	0.178
1981	3,748	0.057	0.121	0.058	0.253	0.228	0.133	0.160
1982	3,752	0.061	0.121	0.064	0.261	0.232	0.140	0.158
1983	4,120	0.076	0.159	0.087	0.246	0.204	0.087	0.111
1984	4,172	0.070	0.140	0.069	0.254	0.218	0.114	0.141
1985	4,127	0.069	0.142	0.070	0.270	0.230	0.128	0.151
1986	4,261	0.076	0.157	0.081	0.273	0.236	0.116	0.143
1987	4,407	0.077	0.156	0.077	0.273	0.241	0.116	0.153
1988	4,237	0.062	0.141	0.068	0.280	0.244	0.139	0.163
1989	4,095	0.055	0.138	0.063	0.286	0.253	0.148	0.173
1990	4,042	0.051	0.134	0.062	0.282	0.244	0.147	0.168
1991	4,137	0.055	0.155	0.072	0.259	0.215	0.104	0.129
1992	4,307	0.057	0.163	0.079	0.245	0.193	0.082	0.111
1993	4,713	0.060	0.171	0.083	0.225	0.179	0.053	0.091
1994	4,985	0.058	0.155	0.070	0.230	0.187	0.075	0.106
1995	5,165	0.060	0.171	0.072	0.230	0.187	0.059	0.105
1996	5,568	0.066	0.193	0.088	0.222	0.170	0.029	0.077
1997	5,605	0.068	0.191	0.089	0.236	0.180	0.046	0.085
1998	5,263	0.065	0.178	0.075	0.289	0.205	0.110	0.119
1999	4,971	0.075	0.194	0.077	0.247	0.198	0.053	0.104
2000	4,947	0.074	0.208	0.088	0.242	0.173	0.034	0.075
2001	4,540	0.080	0.214	0.107	0.268	0.173	0.054	0.062
2002	4,233	0.091	0.214	0.114	0.258	0.172	0.045	0.054
2003	3,992	0.101	0.227	0.133	0.235	0.160	0.008	0.016
2004	3,693	0.109	0.240	0.147	0.225	0.145	−0.015	−0.003
2005	3,549	0.105	0.237	0.148	0.219	0.136	−0.020	−0.005
2006	3,297	0.103	0.232	0.133	0.221	0.146	−0.010	0.015

Paper

Year	Aggregate Cash Ratio	Average Cash Ratio	Median Cash Ratio	Average Legerage	Median Leverage	Average Net Leverage	Median Net Leverage
1980	0.069	0.106	0.054	0.271	0.245	0.165	0.178
1981	0.062	0.119	0.057	0.261	0.231	0.141	0.162
1982	0.065	0.120	0.061	0.266	0.236	0.145	0.158
1983	0.082	0.153	0.083	0.259	0.206	0.106	0.111
1984	0.076	0.138	0.069	0.258	0.218	0.120	0.138
1985	0.078	0.143	0.071	0.266	0.227	0.123	0.141
1986	0.089	0.156	0.081	0.268	0.230	0.113	0.133
1987	0.093	0.153	0.074	0.268	0.234	0.115	0.144
1988	0.081	0.139	0.066	0.272	0.235	0.133	0.147
1989	0.078	0.136	0.061	0.276	0.239	0.140	0.156
1990	0.074	0.131	0.058	0.281	0.235	0.150	0.155
1991	0.077	0.147	0.065	0.257	0.208	0.110	0.119
1992	0.079	0.152	0.070	0.242	0.191	0.090	0.107
1993	0.080	0.156	0.072	0.215	0.159	0.059	0.069
1994	0.080	0.143	0.062	0.221	0.171	0.078	0.086
1995	0.077	0.154	0.064	0.223	0.173	0.069	0.090
1996	0.079	0.174	0.073	0.219	0.166	0.046	0.079
1997	0.079	0.172	0.073	0.232	0.179	0.061	0.089
1998	0.082	0.161	0.065	0.252	0.201	0.092	0.118
1999	0.081	0.175	0.063	0.247	0.200	0.073	0.113
2000	0.078	0.185	0.071	0.234	0.178	0.050	0.080
2001	0.080	0.188	0.080	0.243	0.179	0.056	0.062
2002	0.087	0.186	0.087	0.240	0.174	0.055	0.057
2003	0.101	0.196	0.095	0.218	0.167	0.023	0.020
2004	0.107	0.203	0.103	0.208	0.155	-0.016	-0.005
2005	0.103	0.202	0.102	0.206	0.150	-0.025	-0.004
2006	0.097	0.203	0.095	0.214	0.150	-0.012	0.018

Replication

The research paper examines the cash and debt management practices of a sample of firms from 1980 to 2006. The findings show a consistent upward trend in cash holdings, with the average cash ratio increasing from 10.3% in 1980 to 23.2% in 2006, reaching a peak of 24% in 2004. The median cash ratio also showed an increasing trend, rising from 5.5% in 1980 to 13.3% in 2006. The average leverage of the sample firms declined from 26.9% in 1980 to 22.1% in 2006 and the median leverage declined from 24.3% in 1980 to 14.6% in 2006. The average net debt ratio decreased significantly over the sample period, with firms holding more cash than debt in later years. The Average net leverage declined from 16.4% in 1980 to -1% in 2006. The median net debt ratio also declined from 17.8% in 1980 to 1.5% in

2006, with negative values observed in 2004 and 2005. Overall, the study reveals a consistent increase in cash holdings among the sample firms, leading to a decrease in the net debt ratio.

Extension Table 1:

Year	Aggregate Cash Ratio	Average Cash Ratio	Median Cash Ratio	Average Legerage	Median Leverage	Average Net Leverage	Median Net Leverage
2007	0.093	0.207	0.095	0.218	0.158	0.013	0.057
2008	0.092	0.189	0.092	0.249	0.177	0.011	0.083
2009	0.108	0.202	0.114	0.214	0.148	0.014	0.037
2010	0.113	0.202	0.117	0.207	0.141	0.005	0.023
2011	0.107	0.195	0.107	0.208	0.147	0.013	0.031
2012	0.108	0.191	0.104	0.217	0.158	0.027	0.031
2013	0.112	0.199	0.105	0.225	0.164	0.027	0.034
2014	0.114	0.206	0.099	0.238	0.182	0.023	0.031
2015	0.114	0.206	0.095	0.260	0.203	0.016	0.039
2016	0.116	0.206	0.095	0.265	0.213	0.011	0.039
2017	0.122	0.211	0.096	0.261	0.205	0.011	0.039
2018	0.111	0.218	0.092	0.266	0.204	0.019	0.035
2019	0.112	0.214	0.092	0.290	0.241	0.018	0.039
2020	0.140	0.265	0.141	0.277	0.225	0.014	0.034
2021	0.135	0.294	0.161	0.260	0.200	-0.032	0.009
2022	0.122	0.263	0.128	0.285	0.224	0.012	0.031

The extended paper replication and extension revealed that cash holdings have increased since 2006, with an average cash ratio of 20.7% in 2007 to 26.3% in 2022 and a median cash ratio of 9.5% in 2007 to 12.8% in 2022. Average Net Leverage has also decreased, with an average of 13% in 2007 to 12% in 2022. Median Net leverage ratios have also fallen, with an average of 5.7% in 2007 to 3.1% in 2022.

During the COVID-19 pandemic, U.S. firms witnessed a substantial increase in their average cash ratio from 21.4% in 2019 to 26.5% in 2020, and further to 29.4% in 2021. This surge was primarily driven by a precautionary motive, as companies adopted a cautious approach to safeguard liquidity in the face of unprecedented uncertainties. However, as economic conditions began to stabilize, the average cash ratio gradually reverted to its pre-pandemic level of 21.4% by 2022, indicating a return to normalcy.

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	0.211	0.099	0.086	0.130	0.122	0.101
1981	0.231	0.109	0.092	0.151	0.140	0.115
1982	0.209	0.110	0.103	0.138	0.119	0.122
1983	0.275	0.131	0.118	0.189	0.173	0.153
1984	0.214	0.117	0.101	0.165	0.159	0.132
1985	0.206	0.120	0.106	0.164	0.150	0.138
1986	0.225	0.132	0.111	0.181	0.169	0.151
1987	0.209	0.134	0.109	0.178	0.182	0.143
1988	0.187	0.126	0.103	0.159	0.165	0.129
1989	0.181	0.125	0.098	0.156	0.147	0.132
1990	0.187	0.120	0.097	0.151	0.145	0.128
1991	0.245	0.132	0.103	0.177	0.172	0.144
1992	0.262	0.135	0.104	0.188	0.193	0.146
1993	0.265	0.136	0.105	0.198	0.214	0.148
1994	0.222	0.125	0.092	0.179	0.206	0.132
1995	0.248	0.131	0.096	0.198	0.207	0.152
1996	0.276	0.143	0.097	0.224	0.262	0.154
1997	0.263	0.149	0.102	0.218	0.252	0.154
1998	0.251	0.143	0.088	0.205	0.235	0.140
1999	0.302	0.146	0.084	0.225	0.265	0.145
2000	0.327	0.157	0.079	0.239	0.280	0.144
2001	0.345	0.175	0.090	0.243	0.273	0.147
2002	0.362	0.180	0.099	0.241	0.266	0.160
2003	0.380	0.200	0.126	0.256	0.289	0.182
2004	0.402	0.217	0.131	0.276	0.337	0.189
2005	0.324	0.227	0.131	0.276	0.332	0.188
2006	0.326	0.218	0.120	0.277	0.351	0.176

Paper

	New Issue		Dividend Status		Accounting Performance	
Year	IPO Firms	Non IPO Firms	Dividend Payer	Non Dividend Payer	Negative Net Incom	Nonnegative Net Income
1980	0.209	0.106	0.091	0.136	0.122	0.102
1981	0.230	0.120	0.095	0.157	0.143	0.115
1982	0.202	0.120	0.104	0.143	0.121	0.122
1983	0.274	0.152	0.119	0.191	0.173	0.153
1984	0.211	0.137	0.108	0.169	0.158	0.133
1985	0.202	0.141	0.111	0.174	0.163	0.138
1986	0.238	0.148	0.115	0.190	0.180	0.152
1987	0.225	0.140	0.112	0.187	0.191	0.143
1988	0.191	0.128	0.106	0.166	0.172	0.131
1989	0.180	0.126	0.104	0.163	0.153	0.137
1990	0.177	0.120	0.101	0.155	0.150	0.131
1991	0.227	0.124	0.107	0.180	0.177	0.145
1992	0.237	0.124	0.108	0.188	0.198	0.148
1993	0.250	0.125	0.104	0.201	0.225	0.151
1994	0.210	0.116	0.094	0.184	0.218	0.135
1995	0.230	0.117	0.099	0.200	0.220	0.152
1996	0.252	0.124	0.104	0.228	0.277	0.154
1997	0.237	0.127	0.107	0.222	0.263	0.155
1998	0.213	0.124	0.103	0.205	0.239	0.142
1999	0.246	0.126	0.121	0.217	0.282	0.146
2000	0.261	0.134	0.120	0.233	0.293	0.146
2001	0.269	0.148	0.105	0.248	0.284	0.147
2002	0.271	0.158	0.102	0.247	0.278	0.157
2003	0.302	0.171	0.120	0.258	0.311	0.179
2004	0.327	0.179	0.126	0.271	0.349	0.187
2005	0.310	0.185	0.121	0.276	0.343	0.190
2006	0.282	0.191	0.118	0.278	0.355	0.184

Replication

The average cash ratio for IPO firms in 1980 was 21.1%, which declines to 32.6% in 2006. Meanwhile, non-IPO firms experience more than a doubling of their average cash ratio, from 9.9% to 21.8%. The time trend estimation reveals significant mean and median values for both IPO and non-IPO firms, indicating that the increase in cash holdings is not solely attributed to IPO-related capital raising activities in the sample.

In 2000, the average cash ratio of dividend-paying firms remained relatively stable compared to 1980. However, a remarkable difference was observed in non-dividend-paying firms, with their average (median) cash ratio increasing by 113% (211%) in 2006 compared to 1980. This substantial rise in cash holdings supports the notion that non-dividend-paying firms, likely facing financial constraints, tend to accumulate more cash as a precautionary measure due to limited growth opportunities.

The study reveals a significant trend in firms with negative net income, indicating a dramatic increase in cash holdings. Over the sample period, the average cash ratio for these firms nearly triples, rising from 12.2% in 1980 to 35.1% in 2006. This evidence strongly supports the notion of a precautionary motive behind the surge in cash holdings among financially constrained firms.

Extension Table 2:

	New Issue		Dividend Status		Accounting Performance	
Year	IPO Firms	Non IPO Firms	Dividend Payer	Non Dividend Payer	Negative Net Incom	Nonnegative Net Income
2007	0.302	0.187	0.112	0.285	0.339	0.192
2008	0.271	0.172	0.104	0.260	0.277	0.178
2009	0.266	0.189	0.121	0.265	0.286	0.199
2010	0.272	0.189	0.124	0.268	0.318	0.199
2011	0.267	0.182	0.120	0.263	0.317	0.186
2012	0.264	0.179	0.125	0.258	0.309	0.176
2013	0.296	0.183	0.124	0.275	0.334	0.174
2014	0.328	0.180	0.120	0.294	0.363	0.168
2015	0.332	0.177	0.113	0.299	0.346	0.164
2016	0.334	0.178	0.113	0.298	0.352	0.158
2017	0.339	0.181	0.121	0.300	0.374	0.156
2018	0.370	0.179	0.113	0.318	0.398	0.151
2019	0.365	0.174	0.109	0.308	0.366	0.148
2020	0.407	0.227	0.142	0.365	0.401	0.189
2021	0.455	0.242	0.137	0.403	0.493	0.177
2022	0.425	0.210	0.109	0.373	0.441	0.153

The extension table 2 results are consistent with the original paper's findings, revealing a continuous increase in cash ratios across various categories of firms. Whether IPO or Non-IPO firms, non-Dividend paying firms, or firms with Negative Net Income, all have experienced a rising trend in their cash holdings over time.

3.New Extension:

OLS Regression Results

Dep. Variable:	Long-short portfolio returns	R-squared:	0.052
Model:	OLS	Adj. R-squared:	-0.021
Method:	Least Squares	F-statistic:	0.7067
Date:	Thu, 20 Jul 2023	Prob (F-statistic):	0.554
Time:	20:05:27	Log-Likelihood:	41.033
No. Observations:	43	AIC:	-74.07
Df Residuals:	39	BIC:	-67.02
Df Model:	3		
Covariance Type:	nonrobust		

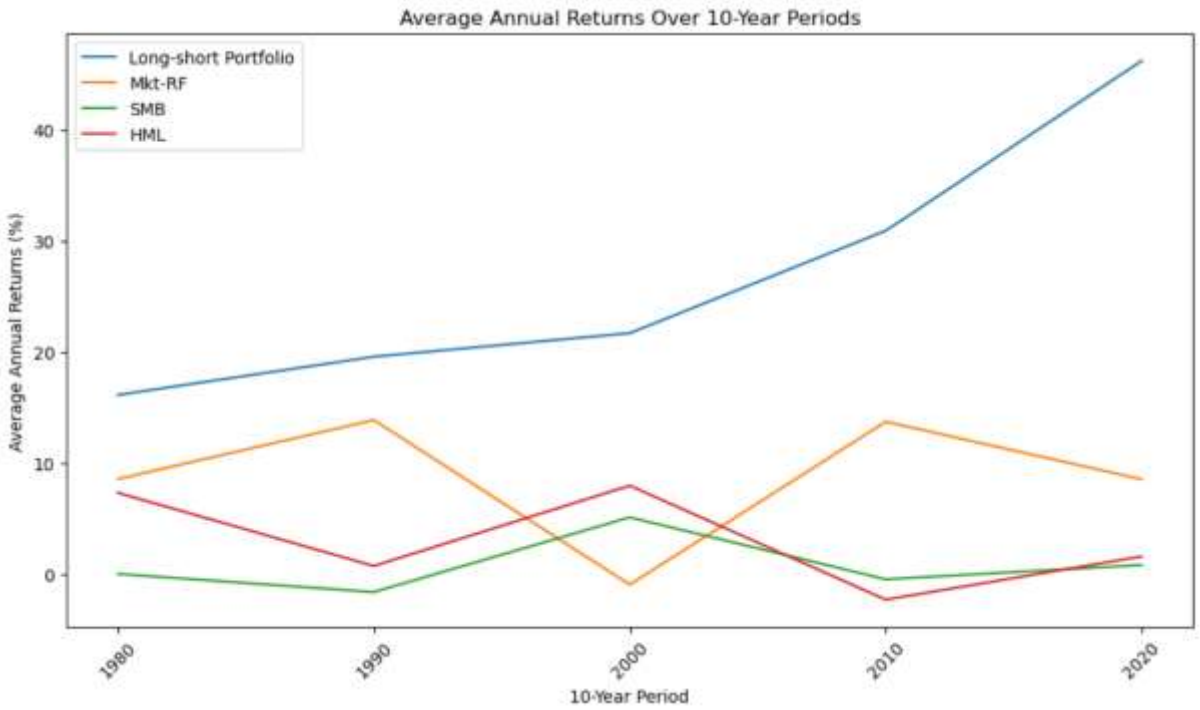
	coef	std err	t	P>|t|	[0.025	0.975]
const	0.2427	0.018	13.704	0.000	0.207	0.279
Mkt-RF	-9.348e-05	0.001	-0.100	0.921	-0.002	0.002
SMB	-0.0015	0.001	-1.002	0.323	-0.005	0.002
HML	-0.0009	0.001	-1.030	0.309	-0.003	0.001

Omnibus:	9.256	Durbin-Watson:	0.320
Prob(Omnibus):	0.010	Jarque-Bera (JB):	8.387
Skew:	1.010	Prob(JB):	0.0151
Kurtosis:	3.773	Cond. No.	24.1

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
Alpha (Intercept) p-value: 1.7109799362543785e-16

The positive Alpha value (const: 0.2427) indicates that the Long-short portfolio, which consists of companies in the big bucket portfolio (high cash ratios) and companies in the Sell bucket portfolio (low cash ratios), is expected to outperform the market and the Fama-French factors (Mkt-RF, SMB, and HML) alone.

In other words, after controlling for the market and the Fama-French factors, the Long-short portfolio still exhibits positive abnormal returns, suggesting that companies with high cash ratios (Big bucket portfolio) have an advantage in terms of returns compared to companies with low cash ratios (Sell bucket portfolio). Since the p-value is very close to zero, we can conclude that the Alpha (intercept) is statistically significant. It indicates that there is a significant excess return in the Long-short portfolio which is not explained by the market, size, and value factors (Mkt-RF, SMB, and HML).



The line chart visually represents these variations in average annual returns, providing insights into the potential benefits and risks associated with the long-short portfolio strategy and its relationship with market and factor movements over time. Overall, the analysis of these variables reveals that the long-short portfolio returns are not solely dependent on the movements of the market, size, or value factors individually. The strategy's performance demonstrates sensitivity to a combination of these factors, indicating the potential for unique investment opportunities and outperformance that cannot be explained solely by traditional market, size, and value factors. This is further supported by the regression analysis results, which show a significant alpha (intercept) p-value, reinforcing the idea of excess returns beyond the examined factors.

4.Regressions Estimating the Determinants of Cash Holdings

In a regression of the average cash-to-assets ratio on a constant and time, time has a significantly positive coefficient, implying that the average cash-to-assets ratio (the cash ratio) has increased by **0.46%** per year.

Another way to see this evolution is that the average cash ratio more than doubled over our sample period, from **10.5%** in 1980 to **23.2%** in 2006.

Table 3:

(Paper)

Model	(1) OLS	(2) OLS	(3) Changes
Dependent variable	Cash/assets	Log (Cash/ net assets)	Cash/assets
Intercept	0.258	-2.305	0.014
	(0.000)	(0.000)	(0.000)
Lag dcash			-0.095
			(0.000)
Lag cash			-0.135
			(0.000)
Industry sigma	0.370	0.455	0.078
	(0.000)	(0.000)	(0.000)
Market to book	0.016	0.173	0.003
	(0.000)	(0.000)	(0.000)
Real size	-0.006	-0.065	0.033
	(0.000)	(0.000)	(0.000)
Cash flow/	-0.001	-0.334	0.035
assets	(0.954)	(0.000)	(0.000)
NWC/ assets	-0.195	-0.552	-0.140
	(0.000)	(0.000)	(0.000)
Capex	-0.291	1.353	-0.179
	(0.000)	(0.000)	(0.000)
Leverage	-0.364	-1.395	-0.188
	(0.000)	(0.000)	(0.000)
R&D/ sales	0.066	0.305	0.010
	(0.000)	(0.000)	(0.000)
Dividend	-0.040	-0.270	0.006
dummy	(0.000)	(0.000)	(0.006)
Acquisition	-0.171	-0.486	-0.133
activity	(0.000)	(0.000)	(0.001)
1990s dummy			
2000s dummy			

Table 3 presents regressions estimating the determinants of cash holdings, focusing on Compustat firm-year observations from 1980 to 2006. The sample includes 117,438 observations for 13,599 unique firms, while the OLS regressions use 100,414 observations for 12,792 firms. The intercept and lagged variables show a decrease in cash ratios, while industry sigma and market to book ratios have positive coefficients, suggesting risk and market value play a role in determining cash holdings. Changes in slopes and intercepts are limited, but a regression that does not account for these changes explains roughly the same amount of variation in cash holdings.

Conclusion

The research paper provides valuable insights into the trends and determinants of cash holdings by U.S. firms from 1980 to 2006 and beyond. The study reveals a significant increase in cash reserves over the years, with the average cash ratio growing from 10.5% in 1980 to 23.2% in 2006, and further to 26.3% in 2022.

The paper identifies various factors contributing to the surge in cash-to-assets ratios, including falling inventories, increased cash flow risk, precautionary motives, reduced capital expenditures, and higher R&D expenses. It also explores the impact of recent macroeconomic events, such as the global financial crisis, geopolitical tensions, the COVID-19 pandemic, rising inflation, and regulatory changes, on cash holdings by U.S. firms.

Further analysis delves into the relationship between cash holdings and factors like new issue status, dividend payment, and accounting performance. The findings indicate that non-dividend paying firms and firms with negative income tend to hold higher levels of cash reserves.

The study adopts robust methodologies, including regression analysis, to investigate the determinants of cash holdings in firms. It explores various factors such as market value, cash flow, firm size, leverage, R&D expenses, acquisitions, interest expense, and more.

The extension analysis, which includes data up to 2022, corroborates the original findings, supporting the positive trend in cash holdings and the decreasing leverage for U.S. firms. Additionally, the paper introduces a Long-short portfolio strategy based on decile buckets of firms' average cash ratios. The strategy shows positive Alpha, indicating that firms with higher cash ratios outperform the market and traditional Fama-French factors, providing insights into the role of cash in firm performance and investment decision-making.

Overall, the paper's comprehensive analysis sheds light on the factors driving the increase in cash holdings and the implications for corporate decision-making, investment, and the economy. The research serves as a vital contribution to understanding the dynamics of cash holdings and their impact on firm performance.