“Do firms park capital? Evidence from the U.S. manufacturing sector”

AUTHORS	Paul Moon Sub Choi https://orcid.org/0000-0003-3338-4728 Francis Joonsung Won

ARTICLE INFO	Paul Moon Sub Choi and Francis Joonsung Won (2018). Do firms park capital? Evidence from the U.S. manufacturing sector. *Investment Management and Financial Innovations*, *15*(2), 194-202. doi: 10.21511/imfi.15(2).2018.17
DOI	http://dx.doi.org/10.21511/imfi.15(2).2018.17
RELEASED ON	Monday, 04 June 2018
RECEIVED ON	Wednesday, 07 March 2018
ACCEPTED ON	Tuesday, 29 May 2018

LICENSE	This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License

JOURNAL	"Investment Management and Financial Innovations"
ISSN PRINT	1810-4967
ISSN ONLINE	1812-9358
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
13	0	6

© The author(s) 2026. This publication is an open access article.

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10, Sumy, 40022, Ukraine

www.businessperspectives.org

Paul Moon Sub Choi (Republic of Korea), **Francis Joonsung Won** (USA)

DO FIRMS PARK CAPITAL? EVIDENCE FROM THE U.S. MANUFACTURING SECTOR

Abstract

This study uses the "cost of carry" (CoC) measure to identify the motive for corporate cash holdings. Based on the historical, moving-average holdings of currency and liquid assets, the measure represents the net opportunity cost of corporate demand for money. This study finds that large manufacturing firms in the U.S. park their capital in short-term assets appealing to the agency motive for cash holdings. Because dividend-paying firms can choose to distribute their capital to equity shareholders when their investment opportunities are unfavorable, these firms might show a non-positive association between capital expenditure and the CoC measure, championing the transactions motive. Still, dividend-paying large firms exhibit an overall positive correlation, suggesting that they park their capital on the agency motive. A detailed literature review and discussions are followed.

Keywords agency cost, Tobin's Q, cash holdings, cost of carry, motives of cash holdings, corporate governance

JEL Classification G39, G34

Received on: 7th of March, 2018
Accepted on: 29th of May, 2018

© Paul Moon Sub Choi, Francis Joonsung Won, 2018

Paul Moon Sub Choi, Associate Professor, College of Business Administration, Ewha Womans University, Republic of Korea.

Francis Joonsung Won, corresponding author, Ph.D. Student, Zicklin School of Business, Baruch College, CUNY, USA.

This is an Open Access article, distributed under the terms of the Creative Commons Attribution-Non-Commercial 4.0 International license, which permits re-use, distribution, and reproduction, provided the materials aren't used for commercial purposes and the original work is properly cited.

INTRODUCTION

Agency theory suggests that firms are prone to make inefficient long-term investments. This research uses Azar et al.'s (2016) "cost of carry" (CoC) measure – defined as the spread of the risk-free rate over the return on the corporate investment portfolio of short-term financial instruments – to study the relationship between fixed investments and corporate cash holdings. The CoC measure is, thus, the net cost of holding cash and cash equivalents or just "cash". By documenting the time-series and cross-sectional variations of non-interest-bearing and liquid assets held by U.S. firms, Azar et al. (2016) conclude that once the cost of carry effect is accounted for, the current U.S. cash holdings do not appear abnormal. This study find evidence of capital "parking" by large firms in the U.S. manufacturing sector banking and report their inefficient cash holdings.

Applying the CoC measure to study the relationship between fixed investments and the cash holdings of firms has three noticeable advantages. First, the CoC measure, as a historical proxy for agency costs, can detect either temporary inefficiencies or chronic liabilities. Second, the measure contains information about the two distinct (transactions and agency) motives for cash holdings. Third, the CoC measure specifically incorporates the transactions motive to estimate the opportunity cost of holding cash. Because it is a historical measure, interpreting the CoC measure at the firm level should reveal how the historical proportion of different cash holdings influences present corporate financial policies.

There is an extensive literature analyzing the agency motive and inefficient cash holdings of large firms. Jensen (1986) illustrates how en-

trenched managers would rather retain cash than increase payouts to shareholders when the firms have poor investment opportunities. Stulz (1990) argues that firms with large cash holdings may invest more than they should. In line with Stulz (1990), Shin and Kim (2002) report that large firms make inefficient corporate investments, in terms of Tobin's Q (1980), in the fourth quarters, controlling for changes in cash holdings. Dittmar et al. (2003) and Pinkowitz et al. (2006) also provide evidence of inefficiency caused by the agency motive for cash holdings.

At the firm level, the CoC measure is technically derived as the share of currency out of the total invested value in liquid assets, scaled by the (risk-free) 3-month Treasury Bill rate. For those firms with a high accumulation of liquid assets in the past (low in terms of the CoC measure), say, for a decade, fixed investments might either increase by "cashing out" the previously held short-term financial instruments or remain stagnant because of uncertain project prospects – leading to an overall non-positive correlation between capital expenditures (CAPEX) and the CoC measure. Corporate demand for money in this case is, thus, based on the transactions motive. However, for the companies that wish to "park" their capital in liquid, short-term assets, even with their large holdings of cash (again low in terms of the CoC measure), concurrent fixed asset investments will decrease – showing an overall positive association with the CoC measure. This scenario is backed by the agency motive for corporate demand for cash.

This study focuses on the large U.S. firms in the manufacturing sector for their sizable fixed asset investment and this feature would render the implication of this research that relates fixed investments to the cost of corporate cash holding more reliable. This study finds that large manufacturing firms in the U.S. park their capital in short-term assets appealing to the agency motive for cash holdings. Because dividend-paying firms can choose to distribute their capital to equity shareholders when their investment opportunities are unfavorable, these firms might show a non-positive association between CAPEX and the CoC measure, championing the transactions motive. Still, dividend-paying large firms exhibit an overall positive correlation, suggesting that they park their capital on the agency motive.

The remainder of this study is organized as follows: section 1 surveys the literature on the corporate motives for cash holdings. The data used and methodologies employed herein are discussed in section 2. Section 3 provides the main results and, lastly, final section concludes this research.

1. LITERATURE REVIEW

1.1. Inefficient cash holding and fixed investments

The agency cost of free cash flow was introduced by Jensen (1986), who illustrates how managers may be motivated to force a firm to grow to more than its optimal level. Such inefficiency arises from managers' being aware of the firm's capital in their control. Managers may fear losing control over the firm's capital if it is paid out by dividends or a payout policy. As a result, entrenched managers would rather retain cash or overinvest instead of increasing payouts to shareholders when the firms have poor investment opportunities. Motivation for inefficient cash holding is also reported in various studies. Dittmar et al. (2003) conducted cross-country analysis of corporate cash holdings and report inefficient cash holding by firms in countries with less protection for shareholders and therefore greater expected agency cost. Similarly, Pinkowitz et al. (2006) show less cash holding in countries with weak shareholder protection.

For studies on firms based in the U.S., Harford et al. (2008) investigated the relationship between corporate governance structure, dividend, fixed investment, acquisition, and cash holdings. Consistent with the prior literature, this study reports a similar relationship in the U.S. between shareholder rights and cash holdings, as well as a negative relationship between governance and cash holding. Excessive investment decisions made by firms facing agency cost are

also largely reported. Stulz (1990) shows that management tends to over- and underinvest at times of low and high cash flow, respectively, resulting in a positive relationship between investment and cash flow. For quarterly investment analysis, Shin and Kim (2002) report an overinvestment pattern of large firms in the last-quarter fixed investments.

However, firms' historical pattern of agency costs has not been examined. It is important for whether agency cost is a temporary inefficiency that can be improved or a chronic complication that cannot be adjusted. Furthermore, the behavior pattern of large firms parking capital in short-term investment or in cash holdings has not yet been reported. Historical examination of cash holdings or investments of firms may be important, because, with accumulated agency cost of cash holding or investment, such firms should be vulnerable to depreciation of the true firm value. In this research, historical cash holding is examined by comparing it with the current capital expenditure to capture the accumulated agency cost of cash holding.

1.2. Transaction motives for cash holding

Baumol (1952) introduced a theoretical explanation of the transaction demand for cash holding by perceiving cash as a part of the holder's inventory kept as a medium of exchange. Miller and Orr (1966) showed similar results and derived the optimal demand for cash by examining the relationship between cost of cash and cash flows. Transaction motives accompany economies of scale, because the transaction fees themselves are limited compared to all the transactions firms face. As a result, cash-holding proportions for the motives for transaction are expected to be lower in large firms, resulting in lower cash as the currency proportion of the total cash holding. In general, for the same fiscal year sample, large firms will have lower cost of carry.

1.3. Intermediate liquidity needs of cash holding

Motives for cash holding other than transaction motives can be classified as the intermediate liquidity needs of cash holding. Such a motive can be represented by precautionary motives for cash holding. A precautionary motive for cash holding can be described as a behavior of holding more cash in order to cope with adverse shocks when access to the capital market is costly. In line with this motive, Opler et al. (1999) found that firms with riskier cash flow and poor access to external capital markets tend to hold a higher ratio of cash to total non-cash assets. Similarly, Almeida et al. (2003) found that constrained firms have positive cash-flow sensitivity (firm's propensity to save cash out of cash flows), whereas there is no relationship between cash saving and cash flows for unconstrained firms. The literature indicates that, although firms may accumulate cash holding in order to cope with shocks, unconstrained firms with full access to the external capital market should have no particular motive for holding larger cash proportions.

1.4. Agency cost of cash holding and investment

For large firms, the intermediate liquidity need for cash holding is inefficient, and therefore can be classified as agency cost of cash holding. Following up on Jensen's (1986) earlier claims on entrenched managers, Dittmar, Marhrt-Smith, and Servaes (2003), Pinkowitz et al. (2006), and Harford et al. (2008) provide evidence of such inefficiencies being prevalent in environments where shareholder rights are not protected and in firms with weak corporate governance, where agency cost is most likely to occur.

Inefficient investment by firms is theoretically revisited by Stulz (1990) who shows that managers overinvest when shareholders have no influence over firms (no influence over a firm is guaranteed by the atomistic shareholder assumption). Shin and Kim (2002) and Harford et al. (2008) provide empirical evidence of overinvestment. In this research, consistent with the prior literature, corporate governance is assumed to be related to firm size, since large firms have more divisions and therefore more managerial issues. Therefore, large firms are expected to face higher agency costs.

2. DATA AND METHODOLOGY

2.1. Data and description of variables

The sample consists of the annual data for U.S.-based manufacturing firms (SIC code 2000-3999) from fiscal years 1980 to 2016 collected from the Compustat Capital IQ database from the WRDS website. This study examines the manufacturing firms in order to obtain comparable results with the prior literature on business fixed investment. Furthermore, fixed investments and cash holdings in other industries (agriculture, retail, finance, and utility) are different from those of the manufacturing industry, and so are excluded from the sample. The variables are calculated based on Shin and Kim (2002). The full sample consists of 30,799 observations and 5,257 firms. This study has excluded observations with negative price per share, book value of assets, and negative total revenue reported by Compustat. The observation number of the sample is approximately 25% of the full dataset from Compustat, because the CoC measure is calculated for firms that were listed for at least 11 years in Compustat, without any missing observations for cash (CH) and cash and short-term investment (CHE). For example, fiscal year 1980 observations are those with nonmissing data of CH and CHE in Compustat from fiscal years 1970 to 1979. All variables are winsorized at the 0.5% level. For variables that need inflation adjustment, they are adjusted to the 1983 CPI index. Size terciles are divided across fiscal years based on the natural log of book value of assets adjusted by the CPI index.

2.2. Descriptive statistics

In Table 2, descriptive statistics show that size terciles do control for the cash-holding motives for transaction for large firms[1]. The mean of the cash as in the currency proportion of large firms is the lowest among the terciles (0.0660 versus 0.0878~0.1279), supporting that the transaction motive for cash holding is affected by economies of scale. Firms within the large tercile have the lowest standard deviation (0.0736 versus 0.1038~0.1708) of cash proportion, showing that the large firms have similar motives for cash as transactions. The mean and median tests of cash proportion confirm the difference in transaction motives between large and small firms.

Table 1. Description of variables

Label	Description	Note
Q	Tobin's Q measured by the market to book ratio	Ratio
CF	Sum of net income and depreciation	Normalized by book value of asset
ΔCash	Change in cash holding	Change
CoC	CoC measure by Azar, Kagy, and Schmalz (2016), modified from 10 to 11 years	Rate
TB3MS	3-month T-bill return from FRED	Rate
DIVDUM	Equal to one if the firm paid dividend or stock repurchase in the observed year	Dummy
CoC x DIVDUM	Interaction term with CoC and DIVDUM	
Size	Book value of asset	Natural log
CH	Non-interest-bearing cash asset	Normalized by book value of asset
CE	Short-term investment only (CHE-CH)	Normalized by book value of asset

Note: *Note that all variables are observed on an annual basis for the 3-month T-Bill rate, rates from FRED for June of every observed year are used.

Large firms in general have lower CoC compared to the full sample. As shown in Table 3, although the mean is not significant (0.0243 versus 0.0283), the median is significantly different (0.0187 versus 0.0235). The skewness measure shows that the distribution of CoC of large firms is more positively skewed, implying that most large firms have lower CoC than other firms. The median of short-term investment yields near zero value suggests that most firms in the sample do not hold or report short-term investments. It is possible that missing short-term investments caused small firms to have higher CoC close to the interest rate. This could be problematic if the full sample is used or size terciles are compared, but the focus of this research is on the agency motives for cash holding by large firms. Although the median for the large firms is also small (0.0012), the non-zero value indicates that large firms did report their short-term investment better than other firms did.

1 Table 1 lists the definitions of variables.

Table 2. Descriptive statistics of the full sample and the size terciles

Sample	Variables	I	Q	CF	ΔCash	CoC	Size	CH	CE	DIVDUM
Full	Nonmissing	33011	33268	33221	32237	33268	33268	33268	33268	33268
	Mean	0.0489	1.7192	–0.0366	2.0663	0.0283	6.1930	0.0939	0.0422	0.5746
	Median	0.0373	1.0551	0.0794	1.0501	0.0235	6.1084	0.0461	0.0000	1.0000
	Std.dev	0.0441	4.8143	1.0213	6.3141	0.0269	2.6280	0.1256	0.1004	0.4944
	Skewness	2.4644	28.7964	–22.817	12.4373	1.2996	0.1169	2.7879	3.5685	–0.3017
	Max	0.4803	278.7900	0.9019	172.3640	0.1473	13.3442	0.9629	0.8503	1.0000
	Min	0.0000	0.0993	–41.389	0.0000	–0.0085	–2.3009	–0.0118	0.0000	0.0000
Large	Nonmissing	11045	11089	11079	10775	11089	11089	11089	11089	11089
	Mean	0.0536	1.3894	0.0911	1.5720	0.0243	8.8529	0.0660	0.0358	0.7951
	Median	0.0443	1.0786	0.0945	1.0739	0.0187	8.8454	0.0395	0.0012	1.0000
	Std.dev	0.0379	1.1140	0.0806	3.6657	0.0228	1.6789	0.0736	0.0733	0.4036
	Skewness	1.8951	4.2171	–2.7712	18.7652	1.3362	0.1319	2.2352	3.3541	–1.4625
	Max	0.4199	21.0300	0.7746	128.3410	0.1473	13.3442	0.7874	0.7091	1.0000
	Min	0.0000	0.0993	–1.3657	0.0000	–0.0085	5.2517	–0.0108	0.0000	0.0000
Small	Nonmissing	10961	11079	11055	10697	11079	11079	11079	11079	11079
	Mean	0.0428	2.4116	–0.2639	2.6516	0.0316	3.5268	0.1279	0.0454	0.3038
	Median	0.0270	1.0435	0.0418	1.0055	0.0282	3.5438	0.0565	0.0000	0.0000
	Std.dev	0.0504	8.1506	1.7389	8.5389	0.0297	1.4157	0.1708	0.1164	0.4599
	Skewness	2.8732	17.5515	–13.483	9.7929	1.1631	–0.2976	2.1893	3.4197	0.8533
	Max	0.4803	278.7900	0.9019	172.3640	0.1473	6.9535	0.9629	0.8503	1.0000
	Min	0.0000	0.1240	–41.389	0.0008	0.0000	–2.3009	–0.0118	0.0000	0.0000
Medium	Nonmissing	11005	11100	11087	10765	11100	11100	11100	11100	11100
	Mean	0.0502	1.3575	0.0623	1.9795	0.0290	6.1969	0.0878	0.0454	0.6245
	Median	0.0387	1.0434	0.0832	1.0612	0.0245	6.2012	0.0460	0.0000	1.0000
	Std.dev	0.0425	1.0989	0.1629	5.7360	0.0274	1.3114	0.1038	0.1062	0.4843
	Skewness	2.3935	4.2844	–23.181	12.1603	1.2646	0.0910	2.1755	3.3370	–0.5143
	Max	0.4286	20.7780	0.9019	138.1620	0.1473	9.0647	0.8953	0.8028	1.0000
	Min	0.0000	0.0993	–9.7566	0.0004	0.0000	3.5420	–0.0118	0.0000	0.0000

Note: The sample includes U.S. based manufacturing firm-year observations between 1980 and 2016. From Compustat (SIC codes 2000-3999) firms with less than 11 periods of observations are excluded are excluded. The size terciles are divided by the natural log of book value of assets. The final sample consists of 31,951 firm-year observations. Variables that need inflation adjustment were adjusted to 1983 CPI index. All variables created are winsorized at 0.5% level.

Table 3. Mean and median tests between large and small firm terciles

	Mean test (t-test)				Median test (Wilcoxon)			
Variables	Large firm	Small firm	t-value	p-value	Large firm	Small firm	z-value	p-value (two-sided)
I	0.0536	0.0428	–17.97	< 0.0001	0.0443	0.027	–38.783	< 0.0001
Q	1.3894	2.4116	13.08	< 0.0001	1.0786	1.0435	–1.342	0.1796
CoC	0.0243	0.0316	20.48	< 0.0001	0.0187	0.0282	15.6429	< 0.0001
CH	0.0736	0.1279	35.04	< 0.0001	0.0395	0.0565	20.481	< 0.0001
CE	0.0358	0.0454	7.34	< 0.0001	0.0012	0	–25.157	< 0.0001
DIVDUM	0.7951	0.3038	–84.52	< 0.0001	1	0	–73.509	< 0.0001

Note: The sample includes U.S. based manufacturing firm-year observations between 1980 and 2016. From Compustat (SIC codes 2000-3999) firms with less than 11 periods of observations are excluded. The size terciles are divided by the natural log of book value of assets. The final sample consists of 31,951 firm-year observations. Variables that need inflation adjustment were adjusted to 1983 CPI index. All variables created are winsorized at 0.5% level.

Table 4. Correlation table of the independent and dependent variables

	Full sample					Large firms				
	I	Q	CF	ΔCash	CoC	I	Q	CF	ΔCash	CoC
	–0.006	–	–	–	–	–0.003	–	–	–	–
Q	0.245	–	–	–	–	0.741	–	–	–	–
	33011	–	–	–	–	11045	–	–	–	–
	0.048	–0.625	–	–	–	0.213	0.377	–	–	–
CF	< .0001	< .0001	–	–	–	< .0001	< .0001	–	–	–
	32977	33221	–	–	–	11035	11079	–	–	–
	–0.013	0.046	–0.030	–	–	–0.032	0.030	0.006	–	–
ΔCash	0.018	< .0001	< .0001	–	–	0.001	0.002	0.566	–	–
	31985	32237	32190	–	–	10732	10775	10765	–	–
	0.179	–0.077	0.055	0.032	–	0.204	–0.103	–0.013	0.043	–
CoC	< .0001	< .0001	< .0001	<.0001	–	< .0001	< .0001	0.169	< .0001	–
	33011	33268	33221	32237	–	11045	11089	11079	10775	–
	0.249	–0.085	0.073	0.004	0.823	0.346	–0.125	0.054	0.011	0.732
TB3MS	< .0001	< .0001	< .0001	0.505	< .0001	< .0001	< .0001	<.0001	0.240	< .0001
	33011	33268	33221	32237	33268	11045	11089	11079	10775	11089

Note: Table 4 shows the Pearson correlation coefficients between the independent and dependent variables. The items are the estimates, p-values and observation numbers, respectively.

The statistics on the dependent variable and the control variables are generally consistent with prior studies. Investment is higher for large firms than for other tercile firms. This can be evident, since the cash flow proxy (CF) is higher and change in cash holding (ΔCash) is lower for large firms. The mean of Tobin's Q of large firms is lower than for the full sample, but the median is similar.

In Table 4, Pearson correlation estimates show a high correlation between the carry measure and the interest rate proxy (TB3MS). The correlation reduces for the large firms subsample, but it is still large and statistically significant enough to be used in the same regression model. Therefore, to investigate the difference between the carry measure and the interest rate, separate regression models are used for comparison of their results.

2.3. Methodology

Following Shin and Kim (2002), Tobin's Q investment model is used, controlling for the cash flow and change in cash holding. Besides, firm and year fixed effects are considered. Cash flow (CF) is a proxy for free cash flow and is expected to have a positive relationship with investment by Jensen's free cash-flow hypothesis of agency-cost theory. Change in cash holding accounts for the firms' investment alternatives. If firms use cash holding as an alternative to capital expenditure, then cash holding will be higher when capital expenditure is lower and vice versa, yielding negative coefficient estimates. The change measure is different from the CoC measure in the sense that it is a proxy for the past one-year change in cash holding, whereas CoC is a historical measure.

Firm and year fixed effects are included, considering the fact that the CoC measure is applied to capture the historical tendencies of individual firms. If only the cross-sectional variation is observed, then the fixed effects may not be necessary. Current focus, however, is to capture the time-series variation within an individual firm, as well as the cross-sectional variation. In addition, capital expenditure is currently calculated as a ratio by normalizing it with the book value of assets.

3. MAIN RESULTS

Table 5 reports the panel regression results of Tobin's Q investment model with the control variables and the CoC measure or the proxy for the interest rate (TB3MS) included. Results indicate that the investments of large firms are positively affected by the CoC measure. The models replacing the carry measure with a proxy for the interest rate (TB3MS) are included to compare how the carry measure and the interest rate influence investment. Interest rate is expected to negatively influ-

Table 5. Panel regressions of corporate investment

Panel regressions with respect to the cost of carry									
Size	**Full sample**			**Large firms**			**Small firms**		
Variables	**Coefficient**	**t-value**	**p-value**	**Coefficient**	**t-value**	**p-value**	**Coefficient**	**t-value**	**p-value**
Q	0.0005	7.44	< .0001	0.0033	9.58	< .0001	0.0003	3.27	0.0011
CF	0.0003	1.13	0.2594	0.0340	9.15	< .0001	–0.0004	–0.99	0.3218
ΔCash	–0.0002	–5.27	< .0001	–0.0003	–4.41	< .0001	–0.0002	–3.29	0.001
Cost of carry	–0.0223	–1.02	0.3062	0.0500	1.85	0.0641	0.0215	0.34	0.7345
FFE	X	–	–	X	–	–	X	–	–
YFE	X	–	–	X	–	–	X	–	–
OBS	31951	–	–	10722	–	–	10568	–	–
R square	0.485	–	–	0.641	–	–	0.432	–	–
Panel regressions with respect to a proxy for interest rate (TB3MS)									
Size	**Full sample**			**Large firms**			**Small firms**		
Variables	**Coefficient**	**t-value**	**p-value**	**Coefficient**	**t-value**	**p-value**	**Coefficient**	**t-value**	**p-value**
Q	0.0005	7.43	< .0001	0.0033	9.54	< .0001	0.0003	3.27	0.0011
CF	0.0003	1.12	0.2612	0.0339	9.12	< .0001	–0.0004	–0.99	0.3214
ΔCash	–0.0002	–5.28	< .0001	–0.0003	–4.39	< .0001	–0.0002	–3.28	0.001
TB3MS	–0.0105	–1.72	0.0861	–0.0061	–0.82	0.4117	–0.0120	–0.86	0.3887
FFE	X	–	–	X	–	–	X	–	–
YFE	X	–	–	X	–	–	X	–	–
OBS	31951	–	–	10722	–	–	10568	–	–
R square	0.485	–	–	0.641	–	–	0.432	–	–

Note: The sample includes U.S. based manufacturing firm-year observations between 1980 and 2016. From Compustat (SIC codes 2000-3999) firms with less than 11 periods of observations are excluded. The dependent variable is corporate fixed investment. The size terciles are divided by the natural log of book value of assets. The final sample consists of 31,951 firm-year observations. Variables that need inflation adjustment were adjusted to 1983 CPI index. All variables created are winsorized at 0.5% level.

ence fixed investments, because it can either provide firms with alternative investments or raise the cost of capital. Interest rate is positively correlated with firms' fixed investments in the descriptive statistics, but interest rates incorporate the aggregate economy's growth options. Controlling for the firm's specific growth opportunities, the relationship should be negative. If the effect of the carry measure on investment is dominated by the effect from the interest rate, then the signs of the coefficients of the carry measure and the interest rate will be identical.

In Table 6, the dividend dummy (equal to 1 if the firm paid a cash dividend or had a stock repurchase program in the observed year) is added and an interaction term with the CoC and the dividend dummy. The dummy and the interaction term are included to observe whether the historical cash-holding level affected fixed investments differently for firms that had a dividend payment schedule in the same year. Dividend-paying firms have the choice to pay dividends instead of parking capital. If such firms faced historically low investment opportunities, the firms can decide to pay dividends and reduce their cash holding. As a result, the tendency to park capital should decrease, leading to a negative coefficient for the interaction term.

Results show that large firms, whether they have a dividend payment schedule or not, do not decide to maintain optimal cash holding. Although the regression yields a negative coefficient for the interaction term, it is statistically insignificant. In contrast, the statistical significance of the CoC measure increases, implying that the historical level of cash holding negatively affects fixed investment. The result suggests that the agency motives for cash holding do not disappear after considering for possible different behaviors of dividend-paying firms. Including the dividend dummy has a minimal effect on the cash-flow proxy, implying that agency cost does not diminish for dividend-paying firms. The coefficient estimate for the dividend dummy yielded a positive value, indicating that firms with dividend policies make more fixed investments. The result is consistent with the agency theory literature, since managers have no incentive to temporarily increase divi-

Table 6. Panel regressions with the cost of carry measure and dividend-related variables

Size	Full sample			Large firms			Small firms		
Variables	Coefficient	t-value	p-value	Coefficient	t-value	p-value	Coefficient	t-value	p-value
Q	0.000475	7.41	< .0001	0.003418	9.81	< .0001	0.00027	3.25	0.0011
CF	0.000318	1.06	0.289	0.031925	8.58	< .0001	–0.00039	–1.01	0.3147
ΔCash	–0.00017	–5.21	< .0001	–0.0003	–4.37	< .0001	–0.00018	–3.28	0.001
CoC	–0.05031	–2.09	0.0367	0.079665	2.39	0.0169	0.001032	0.02	0.9873
divdum	0.00253	3.17	0.0015	0.005056	4.64	< .0001	0.001496	0.79	0.4302
CoC x dum	0.059567	3.25	0.0012	–0.02982	–1.02	0.3078	0.092499	2.26	0.024
FFE	X	–	–	X	–	–	X	–	–
YFE	X	–	–	X	–	–	X	–	–
OBS	31951	–	–	10722	–	–	10568	–	–
R square	0.486	–	–	0.642	–	–	0.433	–	–

Note: The sample includes U.S. based manufacturing firm-year observations between 1980 and 2016. From Compustat (SIC codes 2000-3999) firms with less than 11 periods of observations are excluded. The dependent variable is corporate fixed investment. The size terciles are divided by the natural log of book value of assets. The final sample consists of 31,951 firm-year observations. Variables that need inflation adjustment were adjusted to 1983 CPI index. All variables created are winsorized at 0.5% level.

dends and instead invest more. As a whole, the result can be interpreted as meaning that the agency cost of large firms does not disappear, although much of the literature on finance identifies it as an inefficiency.

Strangely, for the full sample, the firms did lower their cash balance if they were not dividend paying, but considering that the full sample does not control for the transaction motive for cash holding, there is a chance that the transaction motive influenced the result. Middle-size firms were not reported, because they showed statistical inconsistency when the dividend dummy was included. Without the dividend dummy, they appeared to behave like the big firms.

CONCLUSION

This study finds empirical evidence of inefficient behavior of capital parking in the short-term investments of large U.S.-based manufacturing firms, and the effect persists after considering the dividend-payment policies of firms. To identify the inefficiency, the CoC measure is augmented to Tobin's Q investment model. The carry measure has the merit of being a historical average, containing information on the ratio between the motives for cash holding, and calculating the exact opportunity cost of carrying cash as currency. By controlling for size, the large firm subsample is expected to be controlled for the transaction motives for cash, leaving the intermediate liquidity needs of cash holding, as well as the explanatory power of the carry measure on overall cash holding, represented by the cash-to-asset ratio, as proposed by Azar et al. (2016).

The historical examination of the agency cost of firms shows that firms facing such costs may not be able to overcome such problems. If agency costs were temporary irregularities that firms can solve when they are identified, the results would not have been observed. The positive high statistical significance of the CoC measure on firms' fixed investments shows that agency cost is still prevalent in firms and may need further investigation of the firm's fixed investments, the distinct cash holding motives for manager-driven firms, or suboptimal solutions for firms that cannot overcome the inefficiencies.

There are limitations to this study. First, although it empirically identifies inefficient cash holdings, it lacks suggestions on how the firms should behave in order to become efficient. There may be a suboptimal fixed investment and cash-holding level that firms with managerial costs cannot avoid. Second, the suggested model is exposed to misspecification errors that could lead to biased estimators caused by

omitted variables or wrong error structures. Last, no robustness tests are provided. Although the first and the second problem are yet to be solved, simple OLS regression and Fama-Macbeth regression with a Newey-West standard-error-adjusted model lagged by 2 or 3 show consistent results for the large-firm subsamples.

This study contributes to the agency cost of cash holding and investment by investigating the relationship between the historical measure of cash holding and investment to identify a persistent anomaly. Dividend and repurchase programs do not mitigate the effect, further supporting the fact that agency cost is not dissipated by dividends and dividend-related payout policies. The result is independent from the effects of interest rates proxied by three-month T-bill rates.

ACKNOWLEDGEMENT

This work is based on Won's master's thesis at Yonsei University, entitled "Inefficient cash holding: Evidence from the U.S.-based manufacturing large firms". Special thanks are due to Hyun-Han Shin, Shawn Saeyeul Park, and anonymous referees. Standard disclaimer rules apply and all errors are our own.

REFERENCES

1. Almeida, H., Campello, M., & Weisbach, M.S. (2004). The Cash Flow Sensitivity of Cash. *The Journal of Finance, 59,* 1777-1804. https://doi.org/10.1111/j.1540-6261.2004.00679.x
2. Azar, J. A., Kagy, J. F., & Schmalz, M. C. (2016). Can Changes in the Cost of Carry Explain the Dynamics of Corporate "Cash" Holdings? *The Review of Financial Studies, 29,* 2194-2240. https://doi.org/10.1093/rfs/hhw021
3. Baumol, W. J. (1952). The Transaction Demand For Cash: An Inventory Theoretic Approach. *The Quarterly Journal of Economics, 66,* 545-556. https://doi.org/10.2307/1882104
4. Dittmar, A., Marhrt-Smith, J., & Servaes, H. (2003). International Corporate Governance and Corporate Cash Holdings. *Journal of Financial and Quantitative Analysis, 38,* 111-133. https://doi.org/10.2307/4126766
5. Harford, J., Mansi, S. A., & Maxwell W. F. (2008). Corporate governance and firm cash holdings in the US. *Journal of Financial Economics, 87,* 535-555. Retrieved from https://link.springer.com/chapter/10.1007/978-3-642-31579-4_5
6. Jensen, M. C. (1986). Agency Cost of Free Cash Flow, Corporate Finance, And Takeovers. *The American Economic Review, 76,* 323-329. Retrieved from http://www.jstor.org/stable/1818789
7. Miller, M. H., & Orr, D. (1966). A Model of the Demand for Money by Firms. *The Quarterly Journal of Economics, 80,* 413-435. https://doi.org/10.2307/1880728
8. Opler, T., Pinkowitz, L., Stulz, R., & Williamson, R. (1999). The Determinants and Implications of Corporate Cash Holdings. *Journal of Financial Economics, 52,* 3-46. https://doi.org/10.1016/S0304-405X(99)00003-3
9. Pinkowitz, L., Stulz, R., & Williamson, R. (2006). Does the Contribution of Corporate Cash Holdings and Dividends to Firm Value Depend on Governance? A Cross-country Analysis. *The Journal of Finance, 61,* 2725-2751. https://doi.org/10.1111/j.1540-6261.2006.01003.x
10. Shin, H. H., & Kim, Y. H. (2002). Agency Costs and Efficiency of Business Capital Investment: Evidence From Quarterly Capital Expenditures. *Journal of Corporate Finance, 8,* 139-158. https://doi.org/10.1016/S0929-1199(01)00033-5
11. Stulz, R. (1990). Managerial Discretion and Optimal Financing Policies. *Journal of Financial Economics, 26,* 3-27. https://doi.org/10.1016/0304-405X(90)90011-N
12. Tobin, J. (1969). A general equilibrium approach to monetary theory. *Journal of Money, Credit and Banking, 1,* 15-29. https://doi.org/10.2307/1991374/
13. Won, J. (2018). *Inefficient cash holding: Evidence from the U.S.-based manufacturing large firms* (Master's thesis, Yonsei University). Retrieved from http://library.yonsei.ac.kr/search/detail/CAT000001890992