The Impact of COVID-19 on Cash Holdings

Based on Evidence from Chinese Food Manufacturing Firms

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Abstract. This study collected financial panel data of 42 food manufacturing firms from 2014–2022, and finally selected 15 to explore the changes in the impact of each risk on the cash holdings of firms before and after the COVID-19. The risks include market volatility (VaR), market share (MS), inventory turnover ratio (IT), and firm operations (Z-score). The results showed that the epidemic led to significant increase of the firms' cash holdings; In addition to market volatility (VaR), other risks have significant impacts on cash holdings; After the epidemic, the effect of market share (MS) expansion on the decrease of cash holdings was weakened, and the improvement of firm operations (Z-score) changed from significant increase in cash holdings to insignificant.

Keywords: COVID-19 · cash holdings · risks · panel regression

1 Introduction

Cash is the sum of cash on hand, cash in banks and other cash & cash equivalents. The outbreak of COVID-19 makes most firms' finance deteriorated. This study is aim to compare the changes in the impact of various risks on the cash holdings of firms before and after the COVID-19. I choose food manufacturing industry because the Accounting Standards are formulated based on the situation traditional industrial firms, their financial information can be reflected more comprehensively.

2 Literature Review

COVID-19 has caused different impacts between industries1. With positive impact on the E-commerce firms [2], negative impact on Mining industry [3], renewable energy start-ups [4] and small-sized firms [5, 6].Cash is crucial [7–9]. The existing literature highlighted the vital role of cash in practical decisions [10]. This study, in turn, examines what factors influence cash policies.

Volatility is worth considering [11–13]. VaR methods has been wildly used. Such as APARCH model to estimate VaR for East-Asian currencies [14], or estimated equity markets [15], applying the simpler t-EGARCH model [16]. 73% firms report the use of historical simulation [17]. Inventories are vital to keep production running [18]. Similar factors will be added to this model.

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3 Risk and Cash Holding Models

The symbols and definitions used in this paper are shown in Table 1.

The variables used in models are shown in Table 2.

Table 1. Notations

Symbols	Definition	Symbols	Definition
i	Firm number	A	Asset
t	Time, set t = 1 on 2017.06.30	R	Revenue
C	Cash and cash equivalents	I	Inventory
SC	Selling cost	D	Debt
FE	Financial expenses	CA	Current assets
TS	Number of tradable shares	CL	Current liability
NTS	Number of non-tradable shares	UP	Undistributed profit
PBT	Profit before tax	ES	Earned surplus
NAVPS	Net asset value per share	MPPS	Market price per share
W	Time dummy variable, W = 0 when t ≤ 11, W = 1 when t ≥ 12		

Table 2. Variables

Symbols	Definition	Formula
$R'_{i,t}$	Revenue (exclude seasonal variations)	$R'_{i,t_0} = \sum_{t=t_0-3}^{t_0} R_{i,t}$
$VaR'_{i,t}$	market volatility, obtained by calculating prediction interval of $R'_{i,t}$ [19]	$VaR'_{i,t} = t_{\alpha/2}(n-2)\hat{\sigma}\sqrt{1+\frac{1}{n}+\frac{(t_0-\bar{t})^2}{L_{tt}}}$
$VaR_{i,t}$	Dimensionless market volatility	$VaR_{i,t} = VaR'_{i,t}/R_{i,t}$
$MS_{i,t}$	Market share	$MS_{i,t} = R_{i,t}/\sum R_{i,t}$
$IT_{i,t}$	Inventory turnover rate	$IT_{i,t} = \frac{SC_{i,t}}{(I_{i,t-1}+I_{i,t})/2}$
$Zscore_{i,t}$	Altman's Z-score model [20], Reflect the operating situation of firms	$Zscore_{i,t} = 1.2(CA_{i,t} - CL_{i,t})/A_{i,t} + 1.4(UP_{i,t} + ES_{i,t})/A_{i,t} + 3.3(PBT_{i,t} + FE_{i,t})/A_{i,t} + 0.999R_{i,t}/A_{i,t} + 0.6(MPPS_{i,t} \times TS_{i,t} + NAVPS_{i,t} \times NTS_{i,t})/D_{i,t}$
$CHW_{i,t}$	Cash holding will	$CHW_{i,t} = C_{i,t}/R_{i,t}$

4 Panel Regression

$$Model\ 1: \ln CHW_{it} = \lambda W + \beta_0 + \beta_1 \ln VaR_{it} + \beta_2 \ln MS_{it} + \beta_3 \ln IT_{it} + \beta_4 \ln zscore_{it} + \varepsilon_{it}, t \in [1, 22]$$

$$Model\ 2: \ln CHW_{it} = \beta_0 + \beta_1 \ln VaR_{it} + \beta_2 \ln MS_{it} + \beta_3 \ln IT_{it} + \beta_4 \ln score_{it} + \varepsilon_{it}, t \in [1, 11]$$

$$Model\ 3: \ln CHW_{it} = \beta_0 + \beta_1 \ln VaR_{it} + \beta_2 \ln MS_{it} + \beta_3 \ln IT_{it} + \beta_4 \ln score_{it} + \varepsilon_{it}, t \in [12, 22]$$

The result of panel regression is shown in Table 3.

Model 1 is valid. The coefficients of constant term, MS, IT, and Z-score are significant. Larger MS means less risk, the less cash will be held; Larger IT means shorter the production cycle, the more raw materials is needed to put into production, so need more cash to ensure the purchasing power; Larger Z-score means better operation, the more cash is held as a reflection. For W, although it's insignificant, p = 0.148 is still low, which can be interpreted: during the epidemic, firms needs more cash to survival, while the terrible environment causes crisis to some firms and they have to spend cash. The combination of these 2 factors makes the coefficient of W positive, with a smaller p-value but not so significant.

For model 2&3, the coefficients of the constant term and MS are significant, but MS's coefficient becomes larger after the epidemic, indicating that firms are more prudent to hold more cash. The significance of Z-score decreases after the epidemic, indicating that firms differ in cash management due to severe environment. IT regression results are significant, but none of the phased regression results are significant, for reasons unknown and require follow-up research.

Table 3. Result of Panel Regression

	Model 1	**Model 2**	**Model 3**
cons	-3.324***	-4.149***	-2.733***
	(-7.220)	(-6.916)	(-5.073)
VaR	-0.002	-0.123	0.156
	(-0.020)	(-1.093)	(1.056)
MS	-0.898***	-1.191***	-0.81***
	(-6.800)	(-6.248)	(-4.485)
IT	0.116*	0.013	0.087
	(1.830)	(0.178)	(1.283)
Zscore	0.226***	0.221**	0.104
	(2.940)	(2.005)	(0.899)
W	0.184	-	-
	(1.450)	-	-
N	330	165	165
F	42.04***	14.335***	19.366***
$Adj.R^2$	0.406	0.282	0.351

Note: ***, ** and * represent the significance level of 1%, 5% and 10% respectively

5 Robustness Test

To test the robustness of the model, panel regressions of the RE model are done for all periods, pre and post epidemic panel data, respectively (model 4–6). And this paper selects 3 other variables as explanatory variables to substitute into model 1 to test the robustness of the model (model 7–9).

$$CHW_{i,t}^{1} = C_{i,t}/A_{i,t},\ CHW_{i,t}^{2} = C_{i,t}/\left(A_{i,t} - D_{i,t}\right),\ CHW_{i,t}^{3} = C_{i,t}/CA_{i,t}$$

$$Model4: \ln CHW_{it} = u_i + \beta_0 + \beta_1 \ln V_{aR_{it}} + \beta_2 \ln MS_{it} + \beta_3 \ln IT_{it} + \beta_4 \ln Zscore_{it} + \varepsilon_{it}, t \in [1, 22]$$

$$Model5: \ln CHW_{it} = u_i + \beta_0 + \beta_1 \ln VaR_{it} + \beta_2 \ln MS_{it} + \beta_3 \ln IT_{it} + \beta_4 \ln Zscore_{it} + \varepsilon_{it}, t \in [1, 11]$$

$$Model6: \ln CHW_{it} = u_i + \beta_0 + \beta_1 \ln VaR_{it} + \beta_2 \ln MS_{it} + \beta_3 \ln IT_{it} + \beta_4 \ln Zscore_{it} + \varepsilon_{it}, t \in [12, 22]$$

$$Model7: \ln CHW_{it}^{1} = \lambda W + \beta_0 + \beta_1 \ln VaR_{it} + \beta_2 \ln MS_{it} + \beta_3 \ln IT_{it} + \beta_4 \ln Zscore_{it} + \varepsilon_{it}, t \in [1, 22]$$

$$Model8: \ln CHW_{it}^{2} = \lambda W + \beta_0 + \beta_1 \ln VaR_{it} + \beta_2 \ln MS_{it} + \beta_3 \ln IT_{it} + \beta_4 \ln Zscore_{it} + \varepsilon_{it}, t \in [1, 22]$$

$$Model9: \ln CHW_{it}^{3} = \lambda W + \beta_0 + \beta_1 \ln VaR_{it} + \beta_2 \ln MS_{it} + \beta_3 \ln IT_{it} + \beta_4 \ln Zscore_{it} + \varepsilon_{it}, t \in [1, 22]$$

Result shows that the model 4 to 9 are all significant, the sign and significance of the variables are basically the same, indicating that the model is robust.

6 Conclusion and Discussion

I draw following conclusions: (1) Cash holdings are positively correlated with market share, inventory turnover and firm's operation; market volatility has no significant effect on cash holdings. The above variables explain about 40% of the cash holding phenomenon. The epidemic factor promotes firms to hold cash, which is close to 10% significant, maybe some firms have to spend cash to tide over the difficulties. (2) Compared to the pre-epidemic period, the effect of market share expansion on the decrease of cash holding after the epidemic is weaker, and firms are cautious to hold more cash; the improvement of operation increases cash holding from significant to insignificant.

Throughout history, serious epidemics have occurred almost every few decades, this study can provide advice on cash management in future special periods. In addition, during similar periods like natural disasters, this study can be a reference.

This study can't represent the whole manufacturing industry. Due to financial constraints, I wasn't able to visit the field. In addition, the firm's operation and cash holdings may exist mutual affect, which can be a future research direction.

7 Suggestion

I make the following recommendations:

For firms: (1) decrease the scale of production during special periods, and hold more cash to protect against potential risks. (2) pay attention to the firm's operation, including solvency, accumulated profits scale and so on. (3) pay less attention to short-term fluctuations and make long-term business decisions.

For the government: (1) Suggest appropriate relaxation of loans during the epidemic to give the firm more cash to help tide over the difficulties. (2) Give certain tax incentives, such as extending the taxable income loss carry-forward year, raising the tax threshold for small-sized firms.

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