Online Appendix

Impacts of disease pandemics on corporate cash holdings: Evidence from US firms

Identifying the effects of DEXPOSURE on corporate cash holdings: Further Tests

So far, prior exposure to pandemic diseases might at the outset help as well as harm firms in dealing with future disease pandemics. However, both possibilities may suggest that prior pandemic experience should be associated with less negative sentiment related to new or future outbreaks (Hassan et al., 2020). Accordingly, in this subsequent analysis, we bifurcate $DiseaseSentiment_{i,t}^{d}$ into $DiseasePositiveSentiment_{i,t}^{d}$ and $DiseaseNegativeSentiment_{i,t}^{d}$, by conditioning on the use of positive or negative tone sentiment. The results in Table 1A are consistent with the conjecture that firms hold more cash regardless of whether they had a more positive or negative reaction to discussions on disease pandemics during their earnings calls. However, judging by the magnitude (size) of the coefficients, firms that have significantly negative disease-related sentiment scores hold more cash relative to their counterparts. For instance, in Model 12, the estimated coefficient on $DiseasePositiveSentiment_{i,t}^{d}$ and $DiseaseNegativeSentiment_{i,t}^{d}$ shows that, on average, a positive (negative) tone discussion is accompanied by 11.5% (38.7%) increase in cash holdings respectively. This therefore appears to suggest that firms with prior experience are somewhat more positive about the impact of disease pandemics on their business, and therefore will hold less cash. Taken together, these results suggest that a firm's dealings with past pandemic diseases are likely to drive its current or future disease pandemic exposure. This historical experience may improve the firm's sentiment but may not necessarily change its pandemic disease risk, and therefore cash holdings expectations.

[Table 1A about here]

The role of firm life cycle (size and age)

Prior literature (e.g., Arikan and Stulz, 2016; Faff et al., 2016) suggests that firm life cycle has a valuable impact on "real" corporate decisions and outcomes. From its inception to maturity, the financial needs of a firm change by evolving financing preferences and modification in the nature of specific financial choices that the firm makes during its life cycle (La Rocca et al., 2019). In this section, we investigate whether firm life cycle, proxied by firm size and age, influences a firm's decision to accumulate cash in the periods of heightened exposure from disease outbreaks. Specifically, we argue that large and mature firms may have weaker precautionary motives and lower costs of adjustments due to their better access to external financing sources during difficult times (Nguyen, 2019). For instance, some government contracts may be available only to firms that are likely to continue operating for many years. Based on their learning curve, older firms should not only have a longer history of capital market transactions, but should also possess prior experience from previous pandemics, which together equip them to better make more risky choices. Small and young firms are, however, subject to greater informational frictions; therefore, when faced with extreme levels of uncertainty as a result of pandemic exposure, they should reserve more cash to alleviate the sudden shocks to their earnings, production and growth prospects. To test this conjecture, we use the natural logarithm of total assets as the proxy for SIZE, and the natural logarithm of the time between when the firm goes public and the fiscal year as proxy for AGE. We then also construct two dummy variables: LARGE is equal to one if the firm's SIZE is above mean value, and zero otherwise; and MATURE is equal to one if the firm's AGE is the median age value, and zero otherwise (La Rocca et al., 2019).

In Panel A of Table 2A, we segregate our sample based on whether the firm is SMALL or LARGE. The results show a positive and statistically significant (at 1% level) coefficient of pandemic disease exposure (DEXPOSURE, DRISK and DSENTIMENT) on cash holdings for

small firms. For large firms, the pandemic disease exposure coefficients are significantly negative on cash holdings, suggesting that large firms are unruffled by uncertainty during pandemics: their total cash holdings level decreases. In Panel B, we performed a moderation test by incorporating the SIZE and LARGE independently as well as their interacted exposure components (DEXPOSURE*SIZE (*LARGE), DRISK*SIZE (*LARGE) and/or DSENTIMENT*SIZE (LARGE)) to capture the impact of firm size on the relation between pandemic disease exposure and firm cash holdings. The results confirm that the large firms reserve less cash, as indicated by the negative and statistically significant coefficient of the interaction terms, therefore suggesting that large firms put less weight on the precautionary role of cash holdings to guard against any potential risks and undesirable events during pandemic disease outbreaks.

[Table 2A about here]

We follow a similar approach in Table 3A to highlight the impact of firm age. In Panel A, we segregate our sample based on whether the firm is YOUNG or MATURE. The results show that, although both young and mature firms hold cash during disease pandemics, young firms tend to hold significantly greater amounts, as demonstrated by the positive but statistically different significant levels (1% vs 5%) in their coefficients. This therefore suggests that cash holding is much more important for smoothing operations among young firms. The moderation analysis in Panel B places the evidence on firm age effect in a better perspective. The results suggest that the mature firms reserve less cash, as indicated by the negative and statistically significant coefficient of the AGE and MATURE interaction terms. This therefore suggests that, just like large firms, mature firms also put less weight on the precautionary role of cash holdings during pandemic disease outbreaks, perhaps due to their long history, previous

experience and highly stable sources of finance. Overall, the evidence shows that, in the earlier stages of their life cycles, which tend to be associated with larger levels of information asymmetry and more growth opportunities, firms would apply specific financing strategies (e.g. holding more cash) when faced with high uncertainty, different from firms in latter phases of their life cycles.

[Table 3A about here]

References

Arikan, A.M., Stulz, R.M. 2016. Corporate acquisitions, diversification, and the firm's life cycle. *The Journal of Finance, 71*(1), 139-194.

Faff, R., Kwok, W.C., Podolski, E.J., Wong, G. 2016. Do corporate policies follow a life-cycle?. *Journal of Banking & Finance, 69*, 95-107.

Hassan, T.A., Hollander, S., van Lent, L., Tahoun, A. 2020. Firm-level exposure to epidemic diseases: Covid-19, SARS, and H1N1. *National Bureau of Economic Research,* w26971.

La Rocca, M., Staglianò, R., La Rocca, T., Cariola, A., Skatova, E. 2019. Cash holdings and SME performance in Europe: the role of firm-specific and macroeconomic moderators. *Small Business Economics, 53*(4), 1051-1078.

Nguyen, C. 2019. The asymmetry in firms' mechanisms of cash holdings adjustments: evidence from the G-5 economies. *Review of Quantitative Finance and Accounting, 53*(2), 429-463.

Table 1A: Pandemic disease exposure (alternatives) and cash holding.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
					Dependent Variable: $CASH_{t+1}$							
DSENT_POS	0.160***	0.331***	0.093***	0.113***					0.083**	0.287***	0.099***	0.115***
	(0.041)	(0.116)	(0.011)	(0.005)					(0.036)	(0.098)	(0.010)	(0.005)
DSENT_NEG					0.392***	0.501***	0.252***	0.387***	0.392***	0.501***	0.252***	0.387***
					(0.043)	(0.042)	(0.033)	(0.011)	(0.043)	(0.042)	(0.033)	(0.011)
SIZE		-0.040***	-0.047***	-0.012***		-0.039***	-0.045***	-0.012***		-0.039***	-0.045***	-0.012***
		(0.005)	(0.006)	(0.001)		(0.005)	(0.005)	(0.001)		(0.005)	(0.005)	(0.001)
TQ		0.010***	0.010***	0.003***		0.009***	0.009***	0.003***		0.009***	0.009***	0.003***
		(0.001)	(0.001)	(0.000)		(0.001)	(0.001)	(0.000)		(0.001)	(0.001)	(0.000)
ROA		0.058**	0.064	0.071***		0.041	0.050	0.066***		0.041	0.050	0.066***
		(0.030)	(0.047)	(0.022)		(0.026)	(0.044)	(0.021)		(0.026)	(0.044)	(0.021)
BLEV		-0.066***	-0.067***	-0.017***		-0.050***	-0.053***	-0.013***		-0.050***	-0.053***	-0.013***
		(0.008)	(0.010)	(0.003)		(0.006)	(0.008)	(0.003)		(0.006)	(0.008)	(0.003)
EVOL		0.064**	-0.025	-0.007		0.066*	-0.023	-0.006		0.066*	-0.023	-0.006
		(0.030)	(0.046)	(0.012)		(0.037)	(0.050)	(0.013)		(0.037)	(0.050)	(0.013)
DIV		-0.002	-0.004	0.001		-0.003	-0.004	0.000		-0.003	-0.004	0.000
		(0.003)	(0.004)	(0.001)		(0.003)	(0.004)	(0.001)		(0.003)	(0.004)	(0.001)
CAPEX		-0.000	-0.011**	-0.001		-0.000	-0.011***	-0.002		-0.000	-0.011***	-0.002
		(0.000)	(0.004)	(0.002)		(0.000)	(0.004)	(0.002)		(0.000)	(0.004)	(0.002)
TANG		-0.454***	-0.435***	-0.147***		-0.392***	-0.375***	-0.131***		-0.392***	-0.375***	-0.131***
		(0.046)	(0.040)	(0.011)		(0.045)	(0.041)	(0.012)		(0.045)	(0.041)	(0.012)
CONST		0.016***	0.015**	0.006***		0.012***	0.011*	0.004**		0.012***	0.011*	0.004**
		(0.004)	(0.006)	(0.002)		(0.004)	(0.006)	(0.002)		(0.004)	(0.006)	(0.002)
HHI		-0.000	0.001	0.001		-0.001	0.000	0.001		-0.000	0.000	0.001
		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
RETURN		0.001	0.000	0.002		0.002	0.001	0.002		0.002	0.001	0.002
		(0.001)	(0.002)	(0.001)		(0.001)	(0.002)	(0.001)		(0.001)	(0.002)	(0.001)
FAGE		-0.009*	-0.007	-0.002		-0.007*	-0.007	-0.002		-0.007*	-0.007	-0.002
		(0.004)	(0.005)	(0.001)		(0.004)	(0.005)	(0.001)		(0.004)	(0.005)	(0.001)
_cons	0.218***	0.600***	0.654***	-7.332***	0.171***	0.543***	0.589***	-7.157***	0.171***	0.543***	0.589***	-7.157***
	(0.012)	(0.050)	(0.066)	(1.909)	(0.008)	(0.047)	(0.062)	(2.049)	(0.008)	(0.047)	(0.062)	(2.049)
All firm controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
All CEO controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Macro controls	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	132721	107309	52869	50604	132721	107309	52869	50604	132721	107309	52869	50604
R-squared	0.841	0.862	0.829	0.935	0.852	0.869	0.837	0.936	0.852	0.869	0.837	0.936
N_clust	211	210	196	196	211	210	196	196	211	210	196	196

Table 1A reports the estimation results of the effect of disease exposure on cash holding. Standard error robust to heteroscedasticity and clustering at industry level are given in parentheses. Significance indicators: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2A: Pandemic disease exposure, firm size and cash holding.

	Dependent Variable: CASH$_{t+1}$											
	LARGE						SMALL					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DEXPOSURE	-0.197*** (0.052)	-0.297*** (0.029)					0.147*** (0.006)	0.073*** (0.004)				
DRISK			-0.062 (0.042)	-0.104*** (0.039)					0.456*** (0.020)	0.129*** (0.016)		
DSENTIMENT					-0.237*** (0.029)	-0.317*** (0.015)					0.367*** (0.013)	0.230*** (0.007)
TQ	0.015*** (0.002)	0.005*** (0.001)	0.015*** (0.002)	0.005*** (0.001)	0.015*** (0.002)	0.005*** (0.001)	0.010*** (0.001)	0.003*** (0.001)	0.010*** (0.001)	0.003*** (0.001)	0.010*** (0.001)	0.003*** (0.001)
BLEV	-0.042*** (0.010)	-0.012*** (0.003)	-0.042*** (0.010)	-0.012*** (0.003)	-0.042*** (0.010)	-0.012*** (0.003)	-0.083*** (0.019)	-0.025*** (0.004)	-0.083*** (0.019)	-0.025*** (0.004)	-0.083*** (0.019)	-0.025*** (0.004)
TANG	-0.254*** (0.025)	-0.095*** (0.007)	-0.254*** (0.025)	-0.095*** (0.007)	-0.254*** (0.025)	-0.095*** (0.007)	-0.590*** (0.063)	-0.224*** (0.024)	-0.590*** (0.063)	-0.224*** (0.024)	-0.590*** (0.063)	-0.224*** (0.024)
_cons	0.224*** (0.018)	-4.428*** (0.600)	0.224*** (0.018)	-4.428*** (0.601)	0.224*** (0.018)	-4.426*** (0.600)	0.446*** (0.024)	6.873*** (1.871)	0.446*** (0.024)	6.873*** (1.871)	0.446*** (0.024)	6.872*** (1.870)
All firm/CEO controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	70111	70111	70111	70111	70111	70111	55015	55015	55015	55015	55015	55015
R-squared	0.823	0.928	0.823	0.928	0.823	0.928	0.860	0.943	0.860	0.943	0.860	0.943
N_clust	199	198	199	198	199	198	188	185	188	185	188	185

PANEL B

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEXPOSURE	-0.045 (0.412)	-0.023*** (0.008)	-0.843*** (0.077)						
DEXPOSURE × SIZE	-0.013 (0.086)		-0.180*** (0.017)						
DEXPOSURE × LARGE		-1.267*** (0.190)	-2.071*** (0.182)						
DRISK				0.847*** (0.140)	0.562*** (0.067)	-0.924*** (0.188)			
DRISK × SIZE				-0.052 (0.043)		-0.298*** (0.027)			
DRISK × LARGE					-0.447*** (0.062)	-1.832*** (0.134)			
DSENTIMENT							0.158*** (0.017)	0.172*** (0.029)	2.757*** (0.943)
DSENTIMENT × SIZE							-0.087** (0.044)		-0.636*** (0.232)
DSENTIMENT × LARGE								-0.734*** (0.213)	-4.130*** (1.478)
LARGE FIRM		-0.015** (0.007)	-0.015** (0.007)		-0.015** (0.007)	-0.015** (0.007)		-0.015** (0.007)	-0.015** (0.007)
SIZE	-0.039*** (0.005)	-0.036*** (0.005)	-0.036*** (0.005)	-0.039*** (0.005)	-0.036*** (0.005)	-0.036*** (0.005)	-0.039*** (0.005)	-0.036*** (0.005)	-0.036*** (0.005)
TQ	0.009*** (0.001)	0.009*** (0.001)	0.009*** (0.001)	0.009*** (0.001)	0.009*** (0.001)	0.009*** (0.001)	0.009*** (0.001)	0.009*** (0.001)	0.009*** (0.001)
BLEV	-0.050*** (0.006)	-0.050*** (0.006)	-0.050*** (0.006)	-0.050*** (0.006)	-0.050*** (0.006)	-0.050*** (0.006)	-0.050*** (0.006)	-0.050*** (0.006)	-0.050*** (0.006)
TANG	-0.392*** (0.045)	-0.391*** (0.045)	-0.391*** (0.045)	-0.392*** (0.045)	-0.391*** (0.045)	-0.391*** (0.045)	-0.392*** (0.045)	-0.391*** (0.045)	-0.391*** (0.045)
_cons	-2.051 (2.208)	-2.003 (2.225)	-2.003 (2.225)	-2.051 (2.208)	-2.003 (2.225)	-2.003 (2.225)	-2.051 (2.208)	-2.003 (2.225)	-2.002 (2.225)
All firm/CEO controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	125126	125126	125126	125126	125126	125126	125126	125126	125126
R-squared	0.869	0.869	0.869	0.869	0.869	0.869	0.869	0.869	0.869
N_clust	210	210	210	210	210	210	210	210	210

Table 2A reports the estimation results of the effect of firm size on the disease exposure-cash holding nexus. Standard error robust to heteroscedasticity and clustering at industry level are given in parentheses. Significance indicators: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3A: Pandemic disease exposure, firm age and cash holding.

Dependent Variable: $CASH_{t+1}$

	YOUNG						MATURE					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DEXPOSURE	0.095***	0.065***					0.105**	0.065**				
	(0.006)	(0.004)					(0.043)	(0.024)				
DRISK			0.377***	0.242***					0.450**	0.068**		
			(0.067)	(0.018)					(0.181)	(0.028)		
DSENTIMENT					0.299***	0.177***					-0.006	0.035**
					(0.019)	(0.016)					(0.013)	(0.016)
SIZE	-0.037***	-0.010***	-0.037***	-0.010***	-0.037***	-0.010***	-0.041***	-0.014***	-0.041***	-0.014***	-0.041***	-0.014***
	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)	(0.008)	(0.003)	(0.008)	(0.003)	(0.008)	(0.003)
TQ	0.008***	0.003***	0.008***	0.003***	0.008***	0.003***	0.008***	0.003***	0.008***	0.003***	0.008***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
RETURN	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.001	0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
_cons	0.547***	-0.795	0.547***	-0.795	0.547***	-0.795	0.646***	11.095***	0.645***	11.095***	0.646***	11.095***
	(0.035)	(1.569)	(0.035)	(1.569)	(0.035)	(1.569)	(0.069)	(0.259)	(0.069)	(0.259)	(0.069)	(0.259)
All firm/CEO controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	75814	75814	75814	75814	75814	75814	49312	49312	49312	49312	49312	49312
R-squared	0.873	0.943	0.873	0.943	0.873	0.943	0.917	0.955	0.917	0.955	0.917	0.955
N_clust	205	202	205	202	205	202	210	210	210	210	210	210

PANEL B

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEXPOSURE	0.150***	0.056***	0.320***						
	(0.018)	(0.009)	(0.067)						
DEXPOSURE × AGE	-0.082***		-0.244***						
	(0.009)		(0.056)						
DEXPOSURE × MAT		-0.103***	0.219						
		(0.012)	(0.207)						
DRISK				0.147*	0.058***	-0.469***			
				(0.086)	(0.007)	(0.148)			
DRISK × AGE				-0.122*		0.542***			
				(0.077)		(0.260)			
DRISK × MAT					-0.217**	-1.019***			
					(0.098)	(0.460)			
DSENTIMENT							0.191***	0.036***	0.762**
							(0.024)	(0.009)	(0.313)
DSENTIMENT × AGE							-0.153***		-0.718**
							(0.018)		(0.306)
DSENTIMENT × MAT								-0.214***	0.797*
								(0.026)	(0.445)
MATURE FIRM		-0.002	-0.002	-0.002	-0.002	-0.002		-0.002	-0.002
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)		(0.004)	(0.004)
FAGE	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
SIZE	-0.045***	-0.045***	-0.045***	-0.045***	-0.045***	-0.045***	-0.045***	-0.045***	-0.045***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
TQ	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
BLEV	-0.049***	-0.049***	-0.049***	-0.049***	-0.049***	-0.049***	-0.049***	-0.049***	-0.049***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
RETURN	0.005**	0.005**	0.005**	0.005**	0.005**	0.005**	0.005**	0.005**	0.005**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
_cons	52.469***	52.437***	52.437***	52.436***	52.441***	52.441***	52.470***	52.442***	52.438***
	(16.038)	(16.015)	(16.015)	(16.015)	(16.016)	(16.017)	(16.038)	(16.016)	(16.015)
All firm/CEO controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	125126	125126	125126	125126	125126	125126	125126	125126	125126
R-squared	0.918	0.918	0.918	0.918	0.918	0.918	0.918	0.918	0.918
N_clust	201	201	201	201	201	201	201	201	201

Table 3A reports the estimation results of the effect of firm age on the disease exposure-cash holding nexus. Standard error robust to heteroscedasticity and clustering at industry level are given in parentheses. Significance indicators: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$